SOIL SURVEY OF

St. Clair County, Michigan

U.S. Department of Agriculture
Soil Conservation Service
In cooperation with
Michigan Agricultural Experiment Station

Issued May 1974

Major fieldwork for this soil survey was done in the period 1965–68. Soil names and descriptions were appproved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service and the Michigan Agricultural Experiment Station. It is part of the technical assistance furnished to the St. Clair County Soil and Water Conservation District.

Preparation of this soil survey was partly financed by the St. Clair Regional Planning Commission under provisions of an agreement with the Soil Conservation Service, United States Department of Agriculture, and partly by an urban planning grant from the Department of Housing and Urban Development under provisions of Section 701 of the Housing Act of 1954, as amended.

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, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

All the soils of St. Clair County are shown on the detailed map at the back of this soil 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 symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

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

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. 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 section that describes the soils and in the section that discusses capability units and woodland groups.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreational areas in the section "Use of Soils for Community Development."

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

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

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

Cover picture: An area in the Blount-Parkhill soil association.

U.S. GOVERNMENT PRINTING OFFICE: 1974

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Contents

Issued May 1974

SOIL SURVEY OF ST. CLAIR COUNTY, MICHIGAN

BY GILBERT R. LANDTISER, SOIL CONSERVATION SERVICE

FIELDWORK BY GILBERT R. LANDTISER, JERRY D. LARSON, WESLEY K. METTERT, AND THERMAN E. SANDERS, SOIL CONSERVATION SERVICE, AND LIONEL BLOGG, GOVIND PALOOR, AND GARY STEINHARDT, MICHIGAN AGRICULTURAL EXPERIMENT STATION

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH MICHIGAN AGRICULTURAL EXPERIMENT STATION

ST. CLAIR COUNTY lies in the southeastern part of the State of Michigan and it is the easternmost county in the State (fig. 1). The county is bounded on the north

Figure 1.—**Location of St. Clair County in Michigan.**

by Sanilac County, on the west by Lapeer County, on the south by Macomb County, and on the east by Lake Huron and the St. Clair River. The city of Port Huron, the county seat, is 57 miles northeast of Detroit. The total area of St. Clair County is 473,600 acres, or about 740 square miles. In 1970, nearly 118,776 people lived in the county according to U.S. Census data.

How This Survey Was Made

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

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey (*8*).[1]

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. Miami and Wainola 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 those characteristics that affect their behavior in the undisturbed landscape.

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 soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Blount loam, 0 to 2 percent slopes, is one of two phases within the Blount 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.

[1] Italic numbers in parentheses refer to Literature Cited, p. 111.

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. One such kind of mapping unit shown on the soil map of St. Clair County is the soil complex.

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. An example is Wainola-Deford fine sands, 0 to 2 percent slopes.

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. Alluvial land is a land type in St. Clair 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 they 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.

General Soil Map

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

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to 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, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. 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 12 soil associations in this county are described in the following pages.

1. Blount-Parkhill association

Nearly level to gently sloping, somewhat poorly drained and poorly drained soils that have a dominantly loamy subsoil; on till plains

This association is on till plains in the central and western parts of the county. The general landscape is level to gently undulating, and there are a few low ridges and moundlike hills.

This association makes up about 39 percent of the survey area. About 35 percent of this is Blount soils, 30 percent is Parkhill soils, and the remaining 35 percent is minor soils. The Blount soils are somewhat poorly drained and formed in limy silty clay loam glacial till. They have a dark grayish-brown loam surface layer and a grayish-brown loam, clay loam, and clay subsoil. They are nearly level to gently sloping and occur on the higher, slightly convex rises bordering on the drainageways.

The Parkhill soils are poorly drained and formed in limy loam or light clay loam glacial till. These soils have a very dark gray loam surface layer and a dark-gray and gray clay loam and silty clay loam subsoil. They occur in low areas, drainageways, and depressions.

Also in this association are the minor Conover, Metamora, Corunna, Jeddo, Miami, Dighton, and Spinks soils. The Conover and Metamora soils are loamy and somewhat poorly drained. They occur on low mounds, ridges, and rises of the landscape. Corunna and Jeddo soils are loamy and are poorly drained and very poorly drained. They lie in flat, depressed areas. Miami and Dighton soils are loamy and are well drained. They are on the higher part of the landscape. Spinks soils are on uplands and are sandy and well drained.

Most areas of the soils in this association are used for farming. Dairying and growing cash crops are the main kinds of farming. The major soils have a seasonal high water table and need drainage for most uses. Erosion is a moderate hazard on the gentle slopes.

2. Londo-Avoca association

Nearly level to gently sloping, somewhat poorly drained, dominantly high-lime soils that have a loamy to sandy subsoil; on till plains and moraines

This association is on water-laid moraines and till plains in the northeastern part of the county. The general landscape is level to gently undulating, and drainage is mainly to the east.

This association makes up about 4 percent of the survey area. About 65 percent of this is Londo soils, 20 percent is Avoca soils, and the remaining 15 percent is minor soils. The Londo soils are somewhat poorly drained and formed in limy loam glacial till. These soils have a very dark grayish-brown loam surface layer, and a thin, brown and dark grayish-brown clay loam subsoil. They are level to nearly level in the broad upland areas and are gently sloping on the narrow side slopes of drainageways.

The Avoca soils are somewhat poorly drained and formed in 18 to 40 inches of fine sand over limy clay loam glacial till. These soils have a surface layer of very dark brown loamy sand and a subsoil of brown, yellowish-brown, and light brownish-gray fine sand. They are level to very gently sloping and occur in low areas on uplands.

Also in this association are the minor Conover, Croswell, Chelsea, and Parkhill soils and Alluvial land. The Conover soils are loamy and somewhat poorly drained. They occur in the slightly higher areas of the undulating landscape. Croswell and Chelsea soils are sandy and are moderately well drained and well drained. They occur on low mounds and rises. Parkhill soils are poorly drained and dominantly loamy. They are on low flats and in drainageways. Alluvial land is on flood plains and generally is poorly drained.

Most areas of the soils in this association have been cleared and cultivated. Dairying, raising beef cattle, and growing cash crops are the main kinds of farming. The major soils have a seasonal high water table and need drainage for most uses. Erosion is a moderate hazard on the gentle slopes. The Avoca soils have low natural fertility and are droughty in midsummer.

3. *Pert-Sims association*

Nearly level to gently sloping, somewhat poorly drained and poorly drained, dominantly high-lime soils that have a clayey to loamy subsoil; on till plains and moraines

This association occurs on water-laid moraines and till plains in the northeastern part of the county. The general landscape is level to gently undulating.

This association makes up about 3 percent of the survey area. About 50 percent of this is Pert soils, 25 percent is Sims soils, and the remaining 25 percent is minor soils. The Pert soils are somewhat poorly drained and formed in limy silty clay loam glacial till. They have a dark grayish-brown loam surface layer and a thin, dark-brown clay subsoil. They are nearly level to gently sloping and occur on the higher mounds and rises of the landscape.

The Sims soils are poorly drained and formed in limy silty clay loam glacial till. They have a very dark grayish-brown loam surface layer and a dark-gray silty clay loam and clay subsoil. They lie in small depressions, drainageways, and depressed flat areas. Most areas of the Sims soils are in a soil complex with the Pert soils.

Also in this association are the minor Morley and Metea soils. The Morley soils are loamy and clayey and are well drained and moderately well drained. They occur on the strongly sloping and moderately steep side slopes of the deeply cut drainageways. The well-drained, sandy Metea soils are on low ridges, mounds, and rises.

Most areas of the soils in this association have been cleared and cultivated (fig. 2), but some areas along the western edge of the association are still forested. Dairying and growing cash crops are the main kinds of farming.

Figure 2. **Cultivated area in association 3. The crops are small grain and corn. The Pert soils are on the higher knolls and rises, and the Sims soils are in the depressions and narrow drainageways.**

The major soils have a seasonal high water table and need drainage for most uses. Erosion is a moderate hazard on the Pert soils that have gentle slopes.

4. *Hoytville-Allendale-Nappanee association*

Nearly level to gently sloping, very poorly drained and somewhat poorly drained soils that have a clayey to sandy subsoil; on till plains and moraines

This association occurs on water-laid moraines, ground moraines, and till plains in the eastern, central, and western parts of the county. The general landscape is nearly level to gently undulating.

This association makes up about 7 percent of the survey area. About 35 percent of this is Hoytville soils, 25 percent is Allendale soils, 20 percent is Nappanee soils, and the remaining 20 percent is minor soils. The Hoytville soils are very poorly drained and formed in limy clay glacial till. They have a very dark gray silty clay loam surface layer and a dark-gray to gray clay subsoil. They occupy the low, slightly concave depressions, narrow drainageways, and flat areas. The Hoytville soils of this association occur in a soil complex with the Nappanee soils and in a soil complex with the Allendale soils.

The Allendale soils are somewhat poorly drained and formed in 18 to 40 inches of loamy fine sand and fine sand underlain by limy clay till. They have a very dark brown loamy fine sand surface layer and a dark-brown, light yellowish-brown, and yellowish-brown fine sand and loamy fine sand subsoil. These soils are on the higher, slightly convex rises, domelike mounds, and knolls of the landscape.

The Nappanee soils are somewhat poorly drained and formed in limy clay glacial till. They have a dark grayish-brown loam surface layer and a dark grayish-brown clay subsoil. These soils are on the higher, slightly convex mounds and rises of the landscape.

Also in this association are the minor Wainola, Deford, Croswell, Lamson, Wasepi, clay subsoil variant, and Toledo soils. The Wainola soils are somewhat poorly drained; the Deford soils are very poorly drained; and the Croswell soils are moderately well drained. Soils of all three series are sandy. The Lamson soils are poorly drained and loamy. The Wasepi soils, clay subsoil variant, are somewhat poorly drained, loamy soils that are underlain by clayey material. Toledo soils are very poorly drained and clayey. The Croswell soils occur on the slightly higher rises, mounds, and knolls. The other soils occur in nearly level or slightly depressed areas.

Most areas of the soils in this association are used for farming, but much of the eastern part along the St. Clair River has been urbanized. The remaining areas are either farmed or idle. Dairying and cash cropping are the main kinds of farming. The Allendale soils are droughty in midsummer and have a low natural fertility. The major soils have a seasonal high water table and need drainage for most uses. There is a slight hazard of soil blowing on the Allendale soils, and permeability is slow on the Hoytville and Nappanee soils. The Allendale and Hoytville areas of this association are difficult to use for farming because of the extreme differences in their soil textures, and the complexity of their side-by-side occurrence in the landscape.

5. Allendale-Latty association

Nearly level to gently sloping, somewhat poorly drained and very poorly drained soils that have a sandy to clayey subsoil; on the lake plain

This association occurs on the lake plains of the southeastern part of the county. The general landscape is nearly level to very gently undulating.

This association makes up 13 percent of the survey area. About 45 percent of this is Allendale soils, 25 percent is Latty soils, and the remaining 30 percent is minor soils.

The Allendale soils are somewhat poorly drained and formed in 18 to 40 inches of loamy fine sand and fine sand underlain by loamy lacustrine clay. They have a very dark brown loamy fine sand surface layer and a dark-brown, light yellowish-brown, and yellowish-brown fine sand and loamy fine sand subsoil. They occupy the higher domelike mounds, low ridges, knolls, and rises. Most of the acreage of Allendale soils is in a soil complex with the Latty soils and in a soil complex with the Lenawee and Toledo soils.

The Latty soils are very poorly drained and formed in limy lacustrine clay. They have a dark grayish-brown silty clay loam surface layer and a gray clay subsoil. They lie in low, slightly concave depressions, narrow drainageways, and broad flats scattered throughout this association.

Also in this association are the minor Lenawee, Toledo, Croswell, Lamson, and Minoa soils and the Latty complex, sandy subsoil variant. The Lenawee soils are dominantly loamy and are poorly drained. The Toledo soils are dominantly clayey soils and are very poorly drained. The sandy Croswell soils are moderately well drained. Lamson soils are stratified and dominantly loamy and are poorly drained. The Latty complex, sandy subsoil variant, has clayey soils that are underlain by sand and are very poorly drained. Minoa soils are dominantly loamy, stratified, and somewhat poorly drained. The Croswell and Minoa soils occur in the slightly higher rises, mounds, and knolls. The other soils are in level or slightly depressed areas.

Much of this association has been cleared and cultivated. Some areas are forested or idle. Dairying and general cash cropping are the main farming uses. The major soils have a seasonal high water table and need drainage for most uses. The Allendale soils have a low natural fertility, a slight hazard of soil blowing, and a midsummer droughtiness. The Latty soils have very slow permeability. Many areas of this association are difficult to use for farming because of the extreme difference in soil textures and the complexity of their occurrence in the landscape.

6. Paulding-Wasepi, clay subsoil variant, association

Nearly level, very poorly drained and somewhat poorly drained soils that have a clayey to loamy subsoil; on the lake plain and glacial lake beaches

This association occurs on the lake plains and glacial beaches in the southeastern part of the county. The general landscape is level to very gently undulating.

This association makes up about 2 percent of the survey area. About 55 percent of this is Paulding soils; 20 percent is Wasepi soils, clay subsoil variant; and the remaining 25 percent is minor soils. The Paulding soils are very poorly drained and were formed in lacustrine clay. They have a very dark gray clay surface layer and gray clay subsoil. These soils are level or nearly level and occur in broad areas. Soils of the Wasepi series, clay subsoil variant, are somewhat poorly drained and formed in 18 to 40 inches of sandy loam, gravelly loamy sand, and sand underlain by clay. They have a very dark brown sandy loam surface layer and a mottled, dark-brown sandy loam and gravelly loamy sand subsoil. These soils occur on caplike mounds and on long, narrow, convex ridges. These ridges and mounds are oriented in a northeast to southwest direction.

Also in this association are the minor Latty and Toledo soils and the Minoa soils, clay substratum. The Latty and Toledo soils are clayey and are very poorly drained. They occur in low, flat areas and in slight depressions. The Minoa soils, clay substratum, are somewhat poorly drained, stratified, loamy soils that are underlain by clay. They are on mounds and ridges at the slightly higher elevations.

Most areas of the soils in this association have been cleared and are cultivated. Some areas are used for farming, other areas are used for summer resorts along the St. Clair River, and others are idle. Dairying and cash cropping are the main kinds of farming, but some areas are used for permanent pasture. The major soils have a seasonal high water table, and the Paulding soils, as well as the underlying clay materials of the Wasepi soils, clay subsoil variant, have very slow permeability and a high shrink-swell potential. Drainage is needed for most uses, but most areas of the soils are very difficult to drain.

7. Latty association

Nearly level, very poorly drained soils that have a clayey subsoil; on the lake plain

This association occurs on broad lake plains in the southern part of the county. The general landscape is flat.

This association makes up about 4 percent of the survey area. About 80 percent of this is Latty soils, and the remaining 20 percent is minor soils. The Latty soils are very poorly drained and formed in limy lacustrine clays. They have a dark grayish-brown silty clay loam surface layer and a gray clay subsoil. These soils occur in broad, level areas and in low, slightly concave depressions. About half the acreage of the Latty part of this association consists of the Latty complex. This soil complex includes somewhat poorly drained, clayey soils that are similar to the Latty soils. It occurs on the nearly level, slightly convex mounds and very gently sloping rises.

Also in this association are the minor Allendale, Lenawee, Minoa, and Toledo soils. Also included is Alluvial land. The Allendale soils are sandy and somewhat poorly drained. Lenawee soils are dominantly poorly drained. The Toledo soils are stratified and clayey and are very poorly drained. The Allendale and Minoa soils occur on the higher mounds and rises of the landscape. The Lenawee and Toledo soils are in the slight depressions, low areas, and drainageways. Alluvial land is in depressed and generally poorly drained areas of the flood plains.

Most of this association has been cleared and is cultivated. Dairying and cash cropping are the main kinds of farming. The major soils have a seasonally high water table, very slow permeability, and a high shrink-swell potential. Drainage is needed for most uses, but it is difficult to establish in most areas.

8. Wainola-Deford association

Nearly level, somewhat poorly drained and very poorly drained soils that have a sandy subsoil; on glacial lake beaches, outwash plains, and deltas

This association occurs on glacial beaches, outwash plains, and glacial deltas scattered throughout the county. The general landscape is level to very gently undulating.

This association makes up about 9 percent of the survey area. About 35 percent of this is Wainola soils, 25 percent is Deford soils, and the remaining 40 percent is minor soils.

The Wainola soils are somewhat poorly drained and formed in water-laid fine sand. They have a very dark grayish-brown fine sand surface layer and a mainly mottled dark-brown, yellowish-brown, and strong-brown fine sand subsoil. They occupy low, slightly convex mounds, knolls, and rises. Deford soils are very poorly drained and formed in water-laid fine sand. They have a black fine sand surface layer and a gray to dark-gray fine sand and sand subsoil. These soils occupy low, slightly concave depressions, nearly level drainageways, and broad, depressed flats. In most areas of this association, Wainola and Deford soils occur in a soil complex.

Also in this association are the minor Chelsea, Croswell, Gilford, Lamson, Rousseau, Spinks, and Wasepi soils. The Chelsea, Rousseau, and Spinks soils are well drained and sandy; the Croswell soils are moderately well drained and sandy. These soils occur at the higher elevations, on mounds, knolls, and low ridges of the undulating landscape. Gilford soils are poorly drained and sandy. Lamson soils are loamy, stratified, and poorly drained. These soils are in the lower areas and slight depressions. Wasepi soils are somewhat poorly drained and are sandy and loamy. They occur on the low mounds and rises.

Some areas of these soils have been cleared and cultivated, but many areas are idle or have been urbanized. The farmed areas are used mostly for hay and pasture. Dairying and raising beef cattle are the main kinds of farming. The major soils have low natural fertility and low available water capacity. They have a seasonal high water table and need drainage for most uses. Where the water table is low in midsummer, the soils are droughty.

9. Eastport-Wainola-Tobico association

Nearly level to strongly sloping, well-drained, somewhat poorly drained, and very poorly drained soils that have a sandy subsoil; on glacial lake beaches

This association occurs on glacial lake beaches along the shoreline of Lake Huron in the northeastern part of the county. The general landscape is a pattern of ridges and troughs that appear as corrugations and are oriented in a roughly north-south direction.

This association makes up about 1 percent of the survey area. About 40 percent of this is Eastport soils, 30 percent is Wainola soils, 20 percent is Tobico soils, and 10 percent is minor soils.

The Eastport soils are well drained and formed in deep sands. They have a very dark grayish-brown sand surface layer and a dark yellowish-brown, yellowish-brown, and strong-brown sand subsoil. They occur on level to moderately steep mounds, knolls, ridges, and undulating areas.

The Wainola soils are somewhat poorly drained and formed in limy fine sands. They have a very dark grayish-brown fine sand surface layer and a mottled dark-brown and yellowish-brown fine sand subsoil. They occur on low, slightly convex mounds, knolls, and rises. Wainola soils are nearly level to very gently sloping.

The Tobico soils are very poorly drained and formed in water-laid, limy fine sand and sand. They have a black mucky fine sand surface layer and a limy, dark-gray, gray, light brownish-gray and grayish-brown fine sand and sand subsoil. These soils are in low, slightly concave depressions, nearly level drainageways, and broad depressed flats. In this association the Tobico soils occur with Wainola soils in a soil complex.

Also in this association are Alluvial land and the sandy Lake beaches of Lake Huron. These areas are generally poorly drained and occur on the flood plains.

Most areas of the soils in this association were cleared or cut over, but only a few scattered areas are now farmed. Much of this association has been built up with summer-type homes and resorts. The southern part of this association is rapidly becoming urbanized. A few areas are pastured by dairy cattle, and one area has a commercial orchard. The major soils have low natural fertility and low to very low available water capacity. The Wainola and Deford soils have a seasonally high water table and need drainage for most uses. On areas of the Eastport soils that are cultivated or unvegetated, water erosion and soil blowing are slight to moderately severe hazards.

10. Boyer-Wasepi-Spinks association

Nearly level to gently sloping, well-drained and somewhat poorly drained, dominantly sandy soils that have a sandy to loamy subsoil; in glacial drainageways and on glacial lake beaches and outwash plains

This association occurs on the outwash plains, glacial drainageways, and glacial beaches scattered throughout the county. The general landscape is gently undulating and has distinctive, low ridges.

This association makes up about 2 percent of the survey area. About 25 percent of this is Boyer soils, 25 percent is Wasepi soils, 25 percent is Spinks soils, and the remaining 25 percent is minor soils.

Boyer soils are well drained; they formed in loamy sand and sandy loam underlain at a depth of 24 to 40 inches by limy sand and gravel. They have a dark grayish-brown loamy sand surface layer and a brown and dark-brown loamy sand and sandy loam subsoil. They occur on gently sloping mounds, knolls, and low ridges.

The Wasepi soils are somewhat poorly drained; they formed in loamy sand and sandy loam that is underlain at a depth of 24 to 42 inches by stratified sand and gravel. They have a very dark grayish-brown sandy loam surface layer and a mottled dark-brown, grayish-brown, and dark grayish-brown loamy sand and sandy loam subsoil. They occur in low, level to nearly level areas.

The Spinks soils are well drained and formed in sandy and gravelly glacial drift. They have a very dark grayish-brown loamy sand surface layer and a layered, dark yellowish-brown and brown sand and dark-brown and brown loamy sand subsoil. These soils occur on level to gently sloping mounds, knolls, low ridges, and undulating areas.

Also in this association are the minor Avoca, Corunna, Gilford, Lamson, Metamora, Metea, and Otisco soils. The Avoca soils are somewhat poorly drained and sandy soils that are underlain at a depth of 18 to 40 inches by loamy materials. The Corunna soils are loamy and are poorly drained. Gilford soils are poorly drained and loamy; they are underlain at a depth of 24 to 40 inches by limy coarse sand. The Lamson soils are stratified, loamy and sandy, and poorly drained. The Metamora soils are somewhat poorly drained and loamy. The Metea soils are well drained and sandy; they are underlain at a depth of 18 to 40 inches by loamy material. The Otisco soils are loamy and sandy and somewhat poorly drained. The Avoca, Metamora, and Metea soils occur on the slightly higher areas of the undulating landscape. Otisco soils occur on level areas. The Corunna, Gilford, and Lamson soils occur in low, level areas, slight depressions, and drainageways.

Most areas of these soils have been cleared and cultivated, but a few areas are still forested. The main farming uses are for dairying, beef cattle enterprises, and some cash cropping. The major soils have low natural fertility and low available water capacity. The Wasepi soils have a seasonal high water table and need drainage for most uses. Erosion is a moderate hazard on the sloping soils.

11. Bach association

Nearly level, very poorly drained, dominantly high-lime soils that have a loamy subsoil; in glacial drainageways and on the lake plain

This association occurs in glacial drainageways and on lake plains in the northeastern, southern, and western parts of the county. The general landscape is nearly level but has broad, slightly depressed areas.

This association makes up about 10 percent of the survey area. About 45 percent of this is Bach soils, and the remaining 55 percent is minor soils.

Bach soils are very poorly drained soils that formed in limy lacustrine sediments of very fine sandy loam and loamy very fine sand. They have a black very fine sandy loam surface layer and a gray, limy very fine sandy loam subsoil. These soils occur on broad, level areas and depressed flats.

Also in this association are the minor Deford, Houghton, Minoa, Palms, Parkhill, Sanilac, and Thomas soils. The Deford soils are very poorly drained and sandy. The Houghton soils are very poorly drained, deep, organic soils. The Minoa soils are loamy and sandy and are somewhat poorly drained. The Palms are very poorly drained, organic soils that are 16 to 50 inches thick over loamy material. The Parkhill soils are poorly drained and dominantly loamy. The Sanilac soils are somewhat poorly drained, limy, loamy soils. The Minoa and Sanilac soils occur on the slightly higher areas of the landscape. The Thomas soils are limy, loamy, and very poorly drained. The other minor soils of this association are in broad, level areas and depressed flats.

Many areas of these soils have been cleared and cultivated. Large areas are still wooded or covered with sedges, marsh grasses, and reeds. The cultivated areas are used for dairy and beef farming, general cash cropping, and bluegrass sod. The major soils have a very high seasonal water table and are subject to periodic flooding. Drainage is needed for most uses. The Bach soils have a high content of free lime.

12. Alluvial land-Rough broken land association

Nearly level to gently sloping, well-drained to poorly drained soils on flood plains and the adjacent steep to very steep soils on bluffs

This association (fig. 3) occurs on the flood plains and steep bluffs of the major rivers and streams throughout the county. The general landscape is broad to narrow, generally deeply incised valleys.

This association makes up about 6 percent of the survey area. About 45 percent of this is Alluvial land, 15 percent is Rough broken land, and 40 percent is minor soils. Areas of Alluvial land are the active flood plains of the main rivers and streams. This land type is in the lowest positions, or first bottoms, of the flood plains. The soil material consists of layered stream-laid sediments that range from well drained to poorly drained and from sandy to clayey material. Alluvial land is level to gently sloping. Many old stream channels and meanders have left steep, raw banks and gravelly bottoms. The first bottoms are frequently flooded during the entire year.

Rough broken land is strongly sloping to very steep and consists of bluffs and escarpments that border the outer edges of the flood plains and the higher uplands. The soil materials were derived from variable loamy and clayey moraines and till plains, sandy outwash plains and deltas, and clayey lacustrine sediments. The difference in elevation from the tops of the slopes adjoining the uplands to the bottoms of the slopes next to the flood plains ranges from about 10 to 150 feet.

Also in this association are the minor Minoa, Lamson, Boyer, Blount, Paulding, and Toledo soils. The Minoa and Lamson soils occur on second bottoms or higher terraces. The Minoa soils are somewhat poorly drained and loamy and sandy. They are nearly level to very gently sloping and occur on mounds, knolls, and rises. The Lamson soils are poorly drained and loamy and sandy. They occur in low depressions, drainageways, and depressed flats. The Minoa and Lamson soils occur as a soil complex. The second bottoms are flooded mostly in spring and only a few times during the other seasons. In some dry years these areas are not flooded at all. The Boyer, Morley, Blount, Paulding, and Toledo soils occur as small islands in the larger flood plains. The Boyer soils are well drained

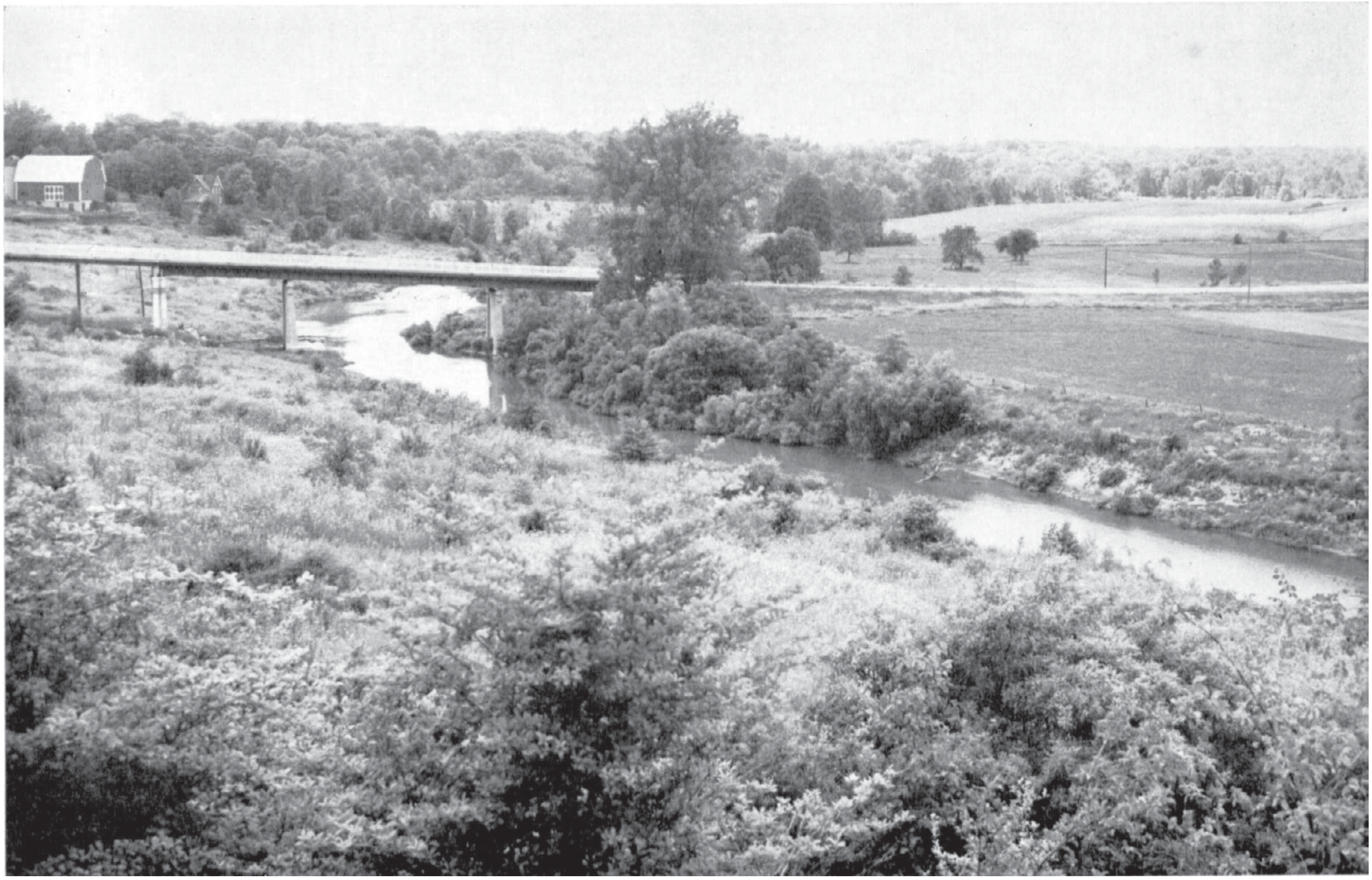

***Figure 3.*—Area of association 12 along the Black River. In foreground is Rough broken land; across the river is Alluvial land.**

and dominantly sandy. The Morley soils are well drained or moderately well drained and are loamy and clayey. Blount soils are somewhat poorly drained and loamy and clayey. Paulding and Toledo soils are very poorly drained and clayey.

Some areas of this association have been cleared and cultivated. The farmable areas of Alluvial land are planted mainly to corn. The Minoa and Lamson soils are suited to small grains, corn, and some hay. Most areas of this association are pastured, forested, or idle and covered with brush. Alluvial land has a seasonal high water table and is subject to flooding. Rough broken land is subject to severe erosion and is too steep and rough for most farm uses. Sidehill seeps, land creep, slides, and sloughing of raw escarpment faces make road building and urban uses of these areas difficult. Many areas of both Alluvial land and Rough broken land are inaccessible to vehicles, and some areas are accessible only by boat.

Descriptions of the Soils

In this section the soils of St. Clair County are described in detail. The procedure is to describe first 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 both the description of that unit and the description of the soil series to which the unit belongs.

Each series description contains a short description of a soil profile considered typical of the series and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations. The colors and the terms for consistence described in the typical profiles are those of a moist soil, unless otherwise noted. Many of the terms used in describing soil series and mapping units are defined in the Glossary, and some are defined in the section "How This Survey Was Made."

The approximate acreage and proportionate extent of the soils are shown in table 1. The "Guide to Mapping Units" lists the mapping units of the county and shows the capability units and woodland groups each mapping unit is in and the page where each of these is described.

The names, descriptions and delineations of soils in this published soil survey do not always agree or join fully with soil maps of adjoining counties published at an earlier date. Differences are brought about by better knowledge about soils or modification and refinements in soil series concepts. In addition, the correlation of a recognized soil is based upon the acreage of that soil and the dissimilarity to adjacent soils within the survey area. Frequently, it is more feasible to include soils, small in extent,

446-054—74——2

Table 1—*Approximate acreage and proportionate extent of soils*

Soil	Acres	Percent
Allendale loamy fine sand, 0 to 3 percent slopes	1, 482	0. 3
Allendale-Hoytville complex, 0 to 6 percent slopes	18, 339	3. 9
Allendale-Latty complex, 0 to 3 percent slopes	14, 533	3. 1
Allendale-Lenawee-Toledo complex, 0 to 3 percent slopes	27, 355	5. 8
Alluvial land	12, 422	2. 6
Avoca loamy sand, 0 to 3 percent slopes	6, 619	1. 4
Bach very fine sandy loam	20, 574	4. 3
Blount loam, 0 to 2 percent slopes	63, 518	13. 4
Blount loam, 2 to 6 percent slopes	28, 478	6. 0
Borrow pits	1, 597	. 3
Boyer loamy sand, 2 to 6 percent slopes	1, 741	. 4
Chelsea-Croswell sands, 0 to 6 percent slopes	8, 463	1. 8
Conover loam, 0 to 2 percent slopes	7, 534	1. 6
Conover loam, 2 to 6 percent slopes	1, 518	. 3
Conover-Parkhill loams, 0 to 2 percent slopes	12, 701	2. 7
Corunna sandy loam	1, 639	. 4
Croswell-Lamson complex, 0 to 6 percent slopes	486	. 1
Deford fine sand	707	. 2
Eastport sand, 0 to 6 percent slopes	1, 755	. 4
Eastport sand, 6 to 18 percent slopes	441	([1])
Gilford sandy loam	946	. 2
Houghton muck	1, 428	. 3
Jeddo silt loam	4, 483	1. 0
Lake beaches	311	([1])
Lamson fine sandy loam	4, 983	1. 0
Latty silty clay loam	7, 025	1. 5
Latty complex, 0 to 3 percent slopes	23, 203	4. 9
Latty complex, sandy subsoil variant, 0 to 3 percent slopes	3, 708	. 8
Lenawee silt loam	2, 211	. 5
Lenawee complex, 0 to 3 percent slopes	765	. 2
Londo loam, 0 to 2 percent slopes	10, 999	2. 3
Londo loam, 2 to 6 percent slopes	1, 679	. 4
Londo complex, 0 to 2 percent slopes	2, 673	. 6
Made land	482	. 1
Metamora sandy loam, 0 to 2 percent slopes	7, 237	1. 5
Metamora sandy loam, 2 to 6 percent slopes	1, 326	. 3
Metamora-Parkhill complex, 0 to 2 percent slopes	8, 244	1. 7
Metea loamy sand, 2 to 6 percent slopes	1, 030	0. 2
Miami loam, 6 to 12 percent slopes	1, 198	. 3
Miami-Dighton sandy loams, 0 to 2 percent slopes	702	. 2
Miami-Dighton sandy loams, 2 to 6 percent slopes	1, 306	. 3
Minoa fine sandy loam, 0 to 2 percent slopes	2, 868	. 6
Minoa fine sandy loam, 2 to 6 percent slopes	684	. 1
Minoa fine sandy loam, clay substratum, 0 to 3 percent slopes	1, 261	. 3
Minoa-Lamson complex, 0 to 3 percent slopes	4, 904	1. 0
Morley loam, 6 to 12 percent slopes, eroded	3, 357	. 7
Morley loam, 12 to 18 percent slopes, eroded	184	([1])
Nappanee-Hoytville complex, 0 to 3 percent slopes	8, 720	1. 8
Otisco loamy sand, 0 to 2 percent slopes	2, 218	. 5
Palms muck	4, 591	1. 0
Parkhill loam	49, 680	10. 5
Paulding clay	4, 741	1. 0
Pert loam, 2 to 6 percent slopes	1, 906	. 4
Pert-Sims loams, 0 to 6 percent slopes	7, 633	1. 6
Pinconning mucky fine sand	357	([1])
Rough broken land	4, 274	. 9
Rousseau fine sand, 0 to 6 percent slopes	5, 287	1. 1
Rousseau fine sand, 6 to 12 percent slopes	352	([1])
Sanilac very fine sandy loam, 0 to 2 percent slopes	3, 620	. 8
Sims loam	1, 002	. 2
Spinks loamy sand, 0 to 2 percent slopes	1, 502	. 3
Spinks loamy sand, 2 to 6 percent slopes	2, 317	. 5
Spinks loamy sand, loamy substratum, 0 to 6 percent slopes	730	. 2
Thomas complex	3, 226	. 7
Toledo silty clay loam	1, 999	. 4
Wainola loamy fine sand, 0 to 2 percent slopes	432	([1])
Wainola-Deford fine sands, 0 to 2 percent slopes	25, 546	5. 4
Wainola-Tobico complex, 0 to 3 percent slopes	3, 177	. 7
Wasepi sandy loam, 0 to 2 percent slopes	3, 666	. 8
Wasepi-Boyer complex, loamy substratum, 0 to 6 percent slopes	3, 371	. 7
Wasepi sandy loam, clay subsoil variant, 0 to 3 percent slopes	2, 154	. 5
Total	473, 600	100. 0

[1] Less than 0.1 percent (474 acres).

with similar soils, where management and response are much the same, rather than to set them apart as individuals. The soil descriptions reflect these combinations. Other differences are brought about by the predominance of different soils in taxonomic units made up of two or three series. Still another difference may be caused by the range in slope allowed within the mapping units for each survey.

Allendale Series

The Allendale series consists of nearly level to gently sloping, somewhat poorly drained soils. These soils formed in water-laid material consisting of 18 to 40 inches of loamy fine sand and fine sand over clay. They occur as low mounds and ridges on level lake plains and till plains and water-laid moraines.

In a typical profile the surface layer is very dark brown loamy fine sand 7 inches thick. The subsoil is 26 inches thick and is loose or very friable. The upper part of the subsoil is a 4-inch layer of dark-brown fine sand; the middle part is light yellowish-brown and yellowish-brown fine sand 13 inches thick. The lower part of the subsoil has an upper layer of dark yellowish-brown fine sand 7 inches thick and a lower layer of grayish-brown loamy fine sand 2 inches thick. The underlying material is brown, calcareous clay that is mottled with gray, light brownish gray, dark brown, strong brown, and light brown.

Surface runoff is slow. Permeability of water is rapid in the sandy upper part of the profile and very slow in the underlying clay. Available water capacity is low in the sandy upper part of the profile and moderate in the underlying clay.

Most areas of Allendale soils have been cleared and cropped. These soils have only a limited use for cultivated crops because their fertility is low, and they occur closely with finer textured and more poorly drained soils. Wetness limits these soils for many nonfarm uses.

Typical profile of Allendale loamy fine sand in an area of Allendale-Latty complex, 0 to 3 percent slopes, NE¼SE¼NE¼ sec. 31, T. 4 N., R. 16 E., 100 feet west of fence along Starville Road and 170 feet south of east-west field fence; in pasture:

Ap—0 to 7 inches, very dark brown (10YR 2/2) loamy fine sand; very weak, fine, subangular blocky structure; very friable; medium acid; abrupt, smooth boundary.

B21hir—7 to 11 inches, dark-brown (10YR 4/3) fine sand; very weak, fine, subangular blocky structure; very friable; medium acid; abrupt, irregular and discontinuous boundary.

B22ir—11 to 18 inches, yellowish-brown (10YR 5/4) fine sand; many, medium, distinct mottles of dark brown (7.5YR 4/4 and 10YR 4/3), strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and dark grayish brown (10YR 4/2); single grain; loose; medium acid; clear, wavy boundary.

B23—18 to 24 inches, light yellowish-brown (10YR 6/4) fine sand; many, medium, faint and distinct mottles of yellowish brown (10YR 5/6, 5/4), pale brown (10YR 6/3), and yellowish red (5YR 4/6); single grain; loose; slightly acid; abrupt, wavy boundary.

B24t—24 to 31 inches, dark yellowish-brown (10YR 4/4) fine sand; many, fine, faint and distinct mottles of yellowish brown (10YR 5/6), pale brown (10YR 6/3), and grayish brown (10YR 5/2); single grain; loose; sand grains coated and weakly bridged with thin clay films; neutral; abrupt, wavy boundary.

B25tg—31 to 33 inches, grayish-brown (10YR 5/2) loamy fine sand; many, fine, distinct mottles of gray (10YR 5/1 and 6/1) and yellowish brown (10YR 5/6); weak, medium, platy structure; very friable; sand grains coated and bridged with thin clay films; neutral; abrupt, wavy boundary.

IICg—33 to 62 inches, brown (7.5YR 5/2) heavy clay; many, medium, distinct mottles of dark brown (7.5YR 4/2), strong brown (7.5YR 5/6), and light brown (7.5YR 6/4); massive; very firm; contains many gray (N 5/0) and light brownish-gray (10YR 6/2) streaks and spots of secondary lime; calcareous.

Thickness of the sandy upper part of the profile and depth to the clayey underlying material are dominantly 20 to 34 inches and range from 18 to 40 inches. The Ap horizon is 7 to 9 inches thick in most places. It is dark brown (10YR 3/3), very dark grayish brown (10YR 3/2), or very dark brown (10YR 2/2). The Ap horizon ranges from loamy fine sand to fine sand. Its reaction ranges from strongly acid to neutral. In undisturbed places an A2 horizon occurs and is grayish-brown (10YR 5/2) or light brownish-gray (10YR 6/2) fine sand. Reaction ranges from strongly acid to slightly acid.

The B21hir horizon ranges from 1 to 9 inches in thickness and is mainly dark brown (7.5YR 4/4 and 10YR 4/3), reddish brown (5YR 4/4), or dark yellowish brown (10YR 4/4). This horizon contains some pellets and chunks of orstein in about 20 percent of the acreage. The B22ir horizon commonly is yellowish brown (10YR 5/4, 5/6, and 5/8). These colors are dominant or are a mixture of fine and medium mottles. The B22ir horizon ranges from strongly acid to slightly acid. Mottles of grayish brown (10YR 5/2), dark grayish brown 10YR 5/1), light brownish gray (10YR 6/2), and gray (10YR 5/1) start in the B22ir horizon or the lower part of the sandy upper story. The loamy fine sand or sandy loam B2t horizons range from 1 to 13 inches in thickness but are dominantly 2 to 8 inches thick. A IIB2 horizon is present in about 30 percent of the area and is mainly 1 to 3 inches thick. Where present, the IIB2 horizon is neutral or mildly alkaline.

The C horizon is clay or silty clay and has a clay content of 40 to 65 percent, depending on the area and its glacial origin.

Allendale soils are similar to Avoca soils; Wasepi soils, clay subsoil variant; and Pinconning and Metea soils. Allendale soils are underlain by finer textured materials than the Avoca soils. The upper part of the Allendale soils is coarser textured and contains less gravel than the Wasepi soils, clay subsoil variant. Allendale soils are better drained than the Pinconning soils and lack their dominantly gray-colored subsoil. In the upper part of the subsoil, Allendale soils have drainage mottles that are not present in the sandy upper part of the Metea soils.

Allendale loamy fine sand, 0 to 3 percent slopes (AeA).—This nearly level or very slightly undulating, somewhat poorly drained soil occurs on small, caplike mounds and in similar areas on the clayey plains. These areas range from 2 to 10 acres in size. The dominant slope is 1 to 2 percent. The profile of this soil is similar to that described as typical for the series, except that in many areas the plow layer is fine sand or sand. In some areas the profile has a 6- to 10-inch layer of finely stratified, limy, sandy to loamy materials just above the clay. In a few areas the profile lacks the dark-brown layer just below the plow layer.

Included with this soil in mapping are areas of moderately well drained, sandy soils underlain by clay. These included soils have short slopes that range from 4 to 5 percent. Also included are a few depressional areas of very poorly drained Pinconning mucky fine sand and a few small moderately eroded spots that are mainly wind eroded.

The main limitations of this soil are the fluctuating high water table, low natural fertility, and midsummer droughtiness. This soil is moderately suited to crops, and most areas have been cleared and cultivated. These areas are mostly idle or are in permanent pasture. Some small, scattered areas are planted to pines and Christmas trees. Capability unit IIIw–7 (4/1b); woodland group 3w2.

Allendale-Hoytville complex, 0 to 6 percent slopes (AhB).—This complex consists of somewhat poorly drained Allendale loamy fine sand and very poorly drained Hoytville silty clay loam. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. They are level to gently undulating. These areas normally range from 40 to 1,500 acres in size. Allendale loamy fine sand makes up about 45 to 55 percent of this complex and is on the higher, slightly convex, domelike mounds, low ridges, and rises. Slopes are short and dominantly range from 2 to 4 percent. Hoytville silty clay loam is nearly level. It makes up about 35 to 45 percent of the complex and is in the lower, slightly concave depressions and in drainageways. These soils have profiles similar to those described as typical for their series, except that in about 10 percent of the area of the Allendale soil, the dark-brown layer just below the plow layer is absent. In scattered small areas, both soils have silty clay loam underlying material.

Included in this complex in mapping are small spots and larger areas of somewhat poorly drained Nappanee loam. This soil lacks the sandy upper part of Allendale loamy fine sand. Also included, on the tops of knolls and ridges, are many small areas of moderately well drained, sandy soils over clay. Other inclusions are small areas of Sims loam. This soil is less clayey than Hoytville silty clay loam. Many small areas and spots occur where the thickness of the sandy materials over the clay is less than 18 inches or more than 40 inches.

Wetness and the extreme difference in texture of the major soils are the main limitations to the use of this complex. Uniform drainage is difficult to obtain. Removing surface water and maintaining tilth are difficult on Hoytville silty clay loam. Midsummer droughtiness, low natural fertility, and a moderate erosion hazard are management concerns on Allendale loamy fine sand. The soils in this complex are moderately suited to most locally adapted crops. Most areas are farmed. Wooded areas of second-growth hardwoods are small and scattered. Capability unit IIIw-11 (4/1b, 1c); Allendale part in woodland group 3w2, Hoytville part in woodland group 3w3.

Allendale-Latty complex, 0 to 3 percent slopes (AlA).—This complex consists of somewhat poorly drained Allendale loamy fine sand and very poorly drained Latty silty clay loam (fig. 4). These soils occur next to each other in areas too small and intricately associated to be mapped separately. They are nearly level to very gently undulating. Normally these areas range from about 40 to 3,000 acres in size. Allendale loamy fine sand makes up about 55 percent of this complex. It occupies the higher, slightly convex, domelike mounds, low ridges, and rises. Slopes are short and dominantly range from 2 to 3 percent. Latty silty clay loam makes up about 35 percent of this complex. It occupies the lower, slightly concave depressions, drainageways, and flat areas. These soils have the profiles described as typical for their series.

Included in mapping in the Allendale loamy fine sand part of this complex are some moderately well drained spots that occur on the steepest slopes, tops of knolls and ridges, and near the edges of this complex where it borders steep bluffs along rivers. Also included are small areas of a soil that has thin layers of finely stratified sandy to loamy materials just above the underlying clay. Many spots and larger areas are included in the Allendale loamy fine sand part of this complex where the thickness of the sand over clay is less than 18 inches or more than 40 inches.

The major limitations to use of this complex are wetness and the extreme difference in the texture of the soils. Uniform drainage is difficult to obtain because relief is undulating in the sandy areas and the clay has very slow permeability. Allendale loamy fine sand has low natural fertility and is droughty in midsummer. Latty silty clay loam is slow to dry out in spring, and the maintenance of good tilth is difficult. The soils in this complex are moderately suited to most locally adapted crops. Most areas are farmed. Capability unit IIIw-11 (4/1b, 1c); Allendale part in woodland group 3w2, Latty part in woodland group 4w1.

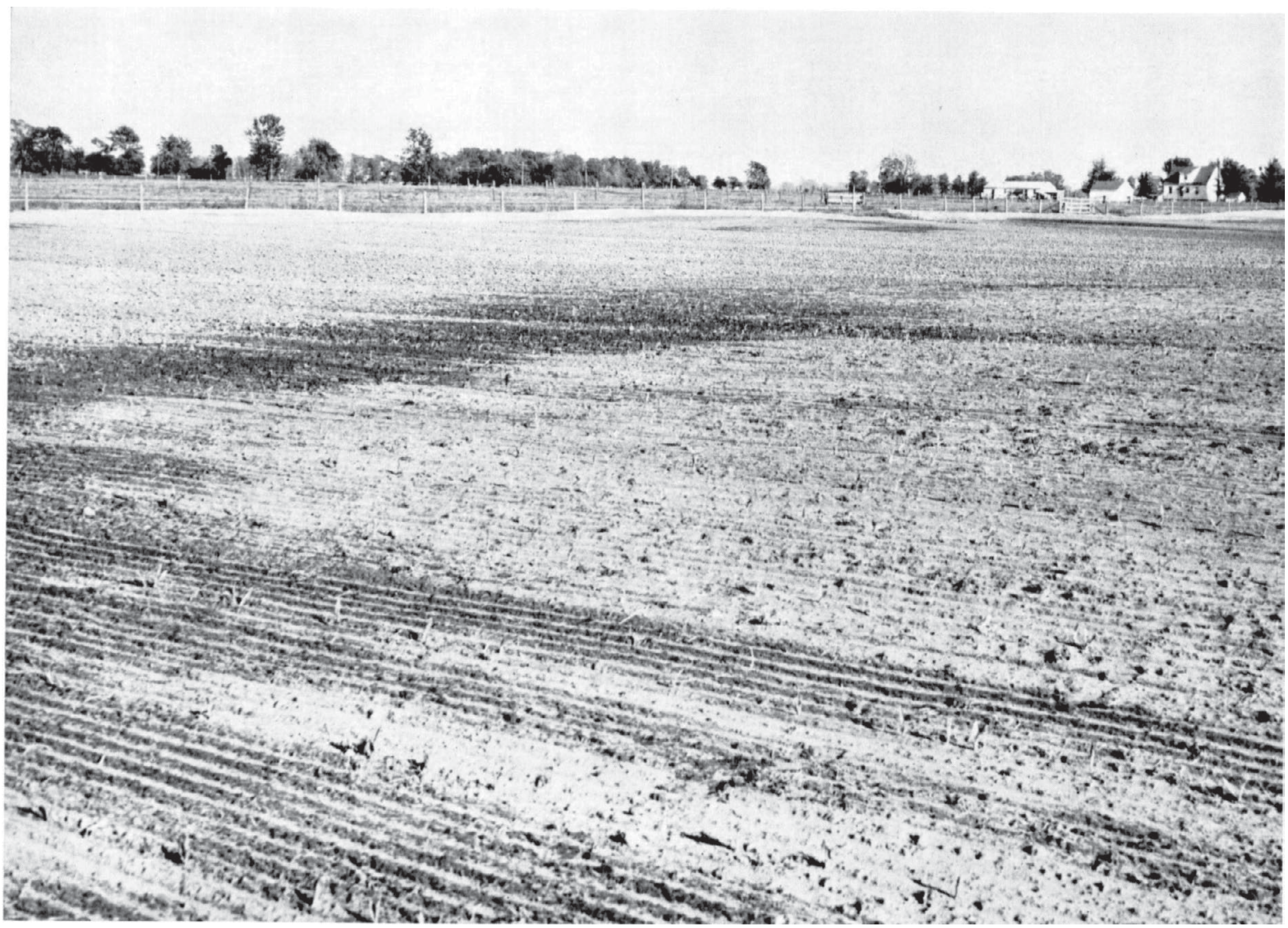

Figure 4.—Area of Allendale-Latty complex, 0 to 3 percent slopes. The light-colored areas are Allendale soil, and the dark-colored areas are Latty soil. Drainage is difficult because of the undulating relief and closed depressions.

Allendale-Lenawee-Toledo complex, 0 to 3 percent slopes (AtA).—This complex consists of somewhat poorly drained Allendale loamy fine sand, poorly drained Lenawee silt loam, and very poorly drained Toledo silty clay loam. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. They are level to very gently undulating and occur in broad areas. These areas normally range from 40 to about 2,000 acres in size. Allendale loamy fine sand makes up about 40 to 50 percent of this complex. It occupies the higher, slightly convex, and domelike mounds, low ridges, and rises. Slopes are short and dominantly range from 2 to 3 percent. Lenawee silt loam and Toledo silty clay loam each makes up about 20 to 25 percent of this complex. These soils are level and occupy the lower, slightly concave depressions and the drainageways. The Allendale and Lenawee soils have profiles similar to those described for their series, except that Allendale loamy fine sand has stratified clayey and loamy underlying material and dark-brown material from the subsoil has been incorporated in the plow layer in some areas. The Lenawee soil has a silty clay loam surface layer in a few areas. The Toledo soil has the profile described as typical for the Toledo series.

Included in mapping in the Allendale loamy fine sand part of this complex are small spots of soils that are sandy over clay but are moderately well drained. Also included are many small areas where the thickness of the sandy materials over the clay is less than 18 inches or more than 40 inches. Some small areas of Lamson fine sandy loam are included in the Lenawee silt loam and the Toledo silty clay loam parts of this complex. Lamson fine sandy loam is a dominantly very fine sandy loam. A few small areas of somewhat poorly drained, stratified, clayey soils are also included in a few places.

Wetness and the extreme textural differences among the soils of this complex are the main limitations to use. Allendale loamy fine sand is droughty during midsummer and has low natural fertility. Lenawee silt loam and Toledo silty clay loam are slow to dry up in spring and occur in areas too widely scattered and small to be properly drained. Uniform drainage is difficult to obtain because permeability is moderately slow to very slow in the loamy and clayey parts of the complex and because relief is undulating. These soils are moderately suited to most locally adapted crops. Most areas of this complex are farmed. Capability unit IIIw-11 (4/1b, 1.5c, 1c); Allendale part in woodland group 3w2, Lenawee and Toledo parts in woodland group 3w3.

Alluvial Land

Alluvial land (0 to 6 percent slopes) (Au) occupies first bottoms on the flood plains of the major rivers and creeks throughout the county. This mapping unit has many very short, strongly sloping to steep slopes along the banks of the old meanders and river channels. Areas range from about 2 acres to 200 acres in size. The soil material consists of stratified mineral material of sand to silty clay texture. The thickness, sequence, and texture of the individual layers are extremely variable within short horizontal distances. Drainage ranges from well drained to poorly drained within short distances. Most of the mapping unit is neutral or calcareous on the surface or in the uppermost 12 inches. Depending on the texture and drainage, some areas are acid to some degree below a depth of 12 inches.

Many areas of this mapping unit along the narrow bottoms of small tributaries are underlain with loamy till or clayey lacustrine materials at a depth of 30 to 60 inches. Included in mapping on the larger flood plains are small islands of loamy or clayey soils, such as Morley loam, Blount loam, Londo loam, Paulding clay, and Toledo silty clay loam. Minoa and Lamson fine sandy loams occur on second bottoms and terraces. Small islands of gravelly Boyer loamy sand are included in some areas.

The main limitations of Alluvial land are flooding, the variability of soil texture, broken surface relief, wetness, and inaccessibility. Flooding is frequent throughout the year and lasts from 3 to about 15 days. The depth of the floodwater ranges from 1 to 10 feet. Drainage is difficult to plan and install because of the choppy surface relief and the lack of proper outlets. Many potentially usable areas of this unit are inaccessible to farm machinery and other uses because of the steep bluffs or the meandering river bed. A few areas are cultivated, mostly to corn. Some areas are used for pasture, but most areas of Alluvial land are idle. Wooded areas are covered with hardwoods. Capability unit Vw-3 (L2c); woodland group not assigned.

Avoca Series

The Avoca series consists of nearly level, somewhat poorly drained soils. These soils formed in 18 to 40 inches of fine sand over limy clay loam glacial till. They occur on knolls and narrow ridges on water-laid moraines.

In a typical profile the surface layer is a very dark brown loamy sand 10 inches thick. The subsurface layer is grayish-brown sand 2 inches thick. The subsoil is 21 inches thick. The upper part of the subsoil is a 6-inch layer of brown, very friable fine sand that has many, distinct, yellowish-red, dark yellowish-brown, yellowish-brown, and grayish-brown spots. The middle part is yellowish-brown, loose fine sand, 8 inches thick, that has distinct, yellowish-brown, pale-brown, grayish-brown and strong-brown spots. The lower part of the subsoil is limy, light brownish-gray, loose fine sand, 7 inches thick, that has faint, grayish-brown and pale-brown spots. The limy underlying material is grayish-brown light clay loam that has many small spots and patches of gray and yellowish brown.

Surface runoff is slow. Permeability is rapid in the sandy upper part of the profile and moderately slow in the loamy lower part. The available water capacity is low in the sandy upper part of the profile and high in the loamy lower part.

The Avoca soils have only a limited use for cultivated crops. Wetness limits many nonfarm uses.

Typical profile of Avoca loamy sand, 0 to 3 percent slopes, in a pasture field, in the center of the N½NE¼ SE¼NE¼ sec. 6, T. 7 N., R. 17 E., 300 feet south of old fence row and 375 feet west of fence along State road:

Ap—0 to 10 inches, very dark brown (10YR 2/2) loamy sand; very weak, medium, granular structure; very friable; slightly acid; abrupt, smooth boundary.

A2—10 to 12 inches, grayish-brown (10YR 5/2) sand; single grain; loose; slightly acid; abrupt, irregular boundary.

B21hir—12 to 18 inches, dark-brown (10YR 4/3) fine sand; many, medium, distinct, yellowish-red (5YR 4/6), dark yellowish-brown (10YR 4/4), and yellowish-brown (10YR 5/4) mottles in the upper part and few, fine, faint, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles in the lower part; very weak, fine, subangular blocky structure; very friable; mildly alkaline; abrupt, wavy boundary.

B22ir—18 to 26 inches, yellowish-brown (10YR 5/4) fine sand; many, medium, faint and distinct, yellowish-brown (10YR 5/6 and 5/8), pale-brown (10YR 6/3), grayish-brown (10YR 5/2), and strong-brown (7.5YR 5/6) mottles; single grain; loose; mildly alkaline; abrupt, wavy boundary.

C1—26 to 33 inches, light brownish-gray (10YR 6/2) fine sand; common, medium, faint, grayish-brown (10YR 5/2) and pale-brown (10YR 6/3) mottles; single grain; loose; contains 5 to 7 percent gravel and 1 to 3 percent cobblestones; calcareous; abrupt, wavy boundary.

IIC2g—33 to 54 inches, grayish-brown (10YR 5/2) light clay loam; many, fine, distinct, gray (10YR 5/1) and yellowish-brown (10YR 5/6 and 5/4) mottles; massive; firm; calcareous.

Thickness of the sandy upper part of the profile is dominantly 20 to 35 inches but ranges from 18 to 40 inches. Most profiles have layers of calcareous sand just above the finer textured underlying material. Where the sandy part does not have a calcareous layer, the underlying material is calcareous at the point of contact. The Ap horizon is very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), or very dark gray (10YR 3/1). The Ap horizon is loamy sand, sand, fine sand, or loamy fine sand. The A2 horizon does not occur in all places, but where it is present, this horizon is grayish brown (10YR 5/2) or light brownish gray (10YR 6/2) and is ½ to 3 inches thick.

The B21hir horizon is brown (10YR 4/3), dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4), or dark brown (7.5YR 4/4). Thickness of the B21hir horizon ranges from 1 to 7 inches. The mottles in the B22ir horizon range from faint to prominent, and they appear in the solum at a depth of less than 20 inches from the surface. The B21hir, the B22ir, and B23 horizons range from mainly sand to fine sand. Some of these layers have small amounts of very coarse sand and fine gravel.

Where the C1 horizon is present, this horizon ranges from fine sand to coarse sand and contains a small amount of fine gravel. Reaction of the C1 horizon is mildly alkaline. In some profiles that lack a sandy, calcareous C1 horizon, a IIB horizon has formed in the loamy, midly alkaline underlying material. This IIB horizon is 1 to 2 inches thick. The IICg horizon is commonly grayish brown (10YR 5/2), dark brown (10YR 4/3), or dark grayish brown (10YR 4/2). Mottles are gray (10YR 5/1), brown (10YR 5/3), and yellowish brown (10YR 5/4, 5/6, and 5/8). The IIC horizon is loam, silt loam, clay loam, and silty clay loam. These till materials contain from 3 to 12 percent gravel and from 1 to 3 percent cobblestones.

Avoca soils are similar to Allendale, Metea, Metamora, and Wainola soils. Avoca soils are underlain by coarser textured materials than the Allendale soils. In the sandy upper part of the Avoca soils there are more gray mottles and a more alkaline reaction than in the upper part of the Metea soils. Avoca soils are coarser textured in the upper part than the Metamora soils. Although Avoca and Wainola soils have similar upper parts of fine sand, the Avoca soils are underlain by loamy materials at a depth of 18 to 40 inches, whereas Wainola soils are deep, sandy soils and do not have finer textured materials in the upper 40 inches.

Avoca loamy sand, 0 to 3 percent slopes (AvA).—This somewhat poorly drained, sandy soil is underlain by loamy till materials at a depth of 18 to 40 inches. It is level to very gently sloping or slightly undulating. The areas range from 2 to about 400 acres in size. In small areas this soil has thin very fine sandy loam or silt loam layers just above the underlying till materials. In many, small, scattered areas the soil is not calcareous in the sandy upper materials. In some profiles the top part of the underlying loamy till is leached of its free lime and has formed a layer that is 1 to 5 inches thick and neutral to mildly alkaline in reaction.

Included in many areas mapped as this soil are spots where the sandy overlying materials are less than 18 inches thick, or more than 40 inches thick. Also included are some knolls and narrow ridgelike areas that have slopes of 4 to 5 percent. These areas border on major drainageways. Other inclusions are small areas of Londo loam and Parkhill loam. These dominantly loamy soils generally occur in the bottoms of drainageways and depressions.

Wetness and low natural fertility are the chief limitations of this soil. Most areas have been cleared and cultivated, but many of these areas are now idle or used for permanent pasture. This soil is moderately suited to crops. Drainage is hindered by the tendency of the fine sands to flow when wet, and by the sloughing of ditch banks and plugging of tile lines. The sandy part of this soil has a low available water capacity, and during midsummer it is droughty. Capability unit IIIw–9 (4/2b); woodland group 3w2.

Bach Series

The Bach series consists of nearly level, very poorly drained soils that formed in limy lacustrine sediments of very fine sandy loam and loamy very fine sand. Bach soils occur on broad flats and slightly depressed areas in glacial drainageways and on lake plains.

In a typical profile the surface layer is black, calcareous very fine sandy loam 8 inches thick. The subsoil is 28 inches thick and is made up of several layers of gray, very friable very fine sandy loam. These layers are mottled and have many small spots and patches of strong brown and olive yellow. They are calcareous. The underlying material consists of light brownish-gray very fine sandy loam and loamy very fine sand. The dominant color is contrasted by small patches and spots of yellowish brown and light olive brown.

Surface runoff is very slow or ponded. Permeability and available water capacity are moderate. Most areas of Bach soils are covered with wetland grasses, sedges, and reeds. A few areas are cropped, but they have been artificially drained. Large areas of this soil in the southern part of the county and on the islands in Lake St. Clair are important for summer cottages (fig. 5), boating, and other recreational uses, and projects for the preservation of waterfowl.

Typical profile of Bach very fine sandy loam, in an idle cultivated field on Harsens Island, in ditchbank next to cultivated field, 200 feet east of junction of Voakes and Columbine Roads on south side of Voakes Road, T. 2 N., R. 16 E.:

Ap—0 to 8 inches, black (10YR 2/1) very fine sandy loam; weak, fine, granular structure; very friable; calcareous; abrupt, smooth boundry.

B21g—8 to 13 inches, gray (5Y 5/1) very fine sandy loam; common, medium, prominent, strong-brown (7.5YR 5/6) mottles; very weak, fine, subangular blocky structure; very friable; calcareous; clear, wavy boundary.

B22g—13 to 21 inches, light-gray (5Y 6/1) very fine sandy loam; many, medium, distinct, olive-yellow (2.5Y 6/8) mottles; very weak, medium, subangular blocky structure; very friable; calcareous; clear, wavy boundary.

B23g—21 to 36 inches, light-gray (5Y 6/1) very fine sandy loam; many, medium and coarse, distinct, olive-yellow (2.5Y 6/8) mottles; very weak, coarse, subangular blocky structure; very friable; calcareous; clear, wavy boundary.

Figure 5.—**Bach very fine sandy loam in a recreation area. The building sites for summer cottages have been developed on soil material obtained by excavating the channels.**

C1g—36 to 48 inches, light brownish-gray (2.5Y 6/2) very fine sandy loam; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; massive; very friable; calcareous; clear, wavy boundary.

C2g—48 to 62 inches, light brownish-gray (2.5Y 6/2) loamy very fine sand; common, medium, distinct, light olive-brown (2.5Y 5/4) mottles; single grain; loose; calcareous.

Depth to calcareous material ranges from 0 to 10 inches. In undisturbed areas the A1 horizon is black (10YR 2/1 or 5Y 2/1) and 3 to 6 inches thick. The Ap horizon is black (10YR 2/1 or 5Y 2/1) very fine sandy loam, silt loam, or fine sandy loam. The A1 and Ap horizons have a high organic-matter content. Reactions of the Ap and A1 horizons range from neutral to moderately alkaline in most profiles.

The dominant colors of the B21g horizon are gray (5Y 5/1 or 10YR 5/1), dark gray (5Y 4/1 or 10YR 4/1), or grayish brown (2.5Y 5/2 or 10YR 5/2). Mottles are few to common and distinct to prominent. Mottles have hues of 10YR, 5Y, and 2.5Y, chroma of 1 to 6, and value of 4 to 6. Dominant colors of the B horizons below the B21g horizon range from dark gray (10YR 4/1 or 5Y 4/1) and dark grayish brown (2.5Y 4/2 or 10YR 4/2) to light gray (10YR 6/1 or 5Y 6/1) and light brownish gray (10YR 6/2 or 2.5Y 6/2). The B horizon in the upper 40 inches dominantly has a clay content of less than 18 percent. Commonly, the horizon consists of very fine sandy loam, loam, silt loam, loamy very fine sand, fine sandy loam, and very fine sand. Structure of the layers in the B horizon ranges from very weak to weak, fine to coarse, and platy to subangular blocky.

The colors and textures of the C horizon are approximately the same as those of the B horizon. In some places the C horizon has thin layers of fine sand, light silty clay loam, coarse sand, or fine gravel. The C horizon has little or no structure and is loose or massive.

Bach soils have drainage similar to that of Deford soils. The Bach soils are more alkaline and have a finer textured subsoil than the Deford soils. The Bach and Sanilac soils developed in similar materials, but Bach soils have a darker surface layer and a grayer subsoil than Sanilac soils. The Bach soils are similar to Parkhill and Lamson soils. Bach soils were formed in stratified layers of very fine sand and silt and some clay, but Parkhill soils formed in unstratified loamy materials. The Bach soils are more alkaline and shallower to free lime than the Lamson soils.

Bach very fine sandy loam (0 to 2 percent slopes) (Bc).—This very poorly drained soil occurs in large areas of low flat marshlands, in long narrow drainageways, and in small depressions. These areas range from 10 to 3,500 acres in size. This soil has slightly concave slopes or is level. Some areas that border Lake St. Clair are flooded two-thirds of the year.

Included in mapping are some small areas of very poorly drained Thomas mucky silt loam. This soil has a silty clay loam subsoil. In some areas small islandlike areas consist of limy loamy till materials that are exposed at the surface or occur at a depth of 30 to 40 inches. Also included with this soil are 1- to 3-acre areas of somewhat poorly drained Sanilac very fine sandy loam and very poorly drained Palms muck. Many depressed drainageways have small, year-round spots of shallow ponded water. Many included areas are covered with materials that were dug up from the adjoining drainage ditches and boat canals. This practice is extensive along the main river channels and on the smaller islands. The thickness of the fill material ranges from 1 to several feet.

Wetness, flooding, and the high content of free lime in the upper part of this soil are the major limitations for farming and tree growth. Drainage is difficult because of the very fine sand and the normal lack of a good outlet. This soil tends to flow when it is wet, and ditchbanks are sloughed and tile lines are plugged. This soil is well suited to most locally adapted crops, but it requires adequate drainage. Most areas of this soil in the southern part of the county are too wet for farming or tree growth. The few wooded areas are in the western part of the county. Some areas of this soil are used to produce bluegrass sod for landscaping. In the southern island region of the county, waterfowl projects and sanctuaries use areas of this soil for both crop-producing fields and flooded feeding. Capability unit IIw–6 (2.5c-c); woodland group 4w1.

Blount Series

The Blount series consists of nearly level to gently sloping, somewhat poorly drained soils that formed in limy silty clay loam glacial till. These soils occur on broad, gently undulating till plains.

In a typical profile the surface layer is dark grayish-brown loam that is 9 inches thick. The subsoil is 22 inches thick and consists of three layers. The upper layer is a mixture of pale-brown loam and clay loam that is 4 inches thick. The middle layer is grayish-brown, firm heavy clay loam 8 inches thick. The lower layer is grayish-brown, very firm clay that is 10 inches thick. The limy underlying material is gray and olive brown silty clay loam.

Surface runoff is medium to slow. Permeability is slow. Available water capacity is high. Blount soils are extensive in the county and important to farming. Wetness limits these soils for many nonfarm uses.

Typical profile of Blount loam, 0 to 2 percent slopes, in a cultivated field in the NW¼NW¼NE¼ sec. 3, T. 7 N., R. 15 E., about 245 feet south of Metcalf Road and 1,600 feet from the corner of Metcalf and Kilgore Roads:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, granular structure; very friable; 3 percent coarse fragments; strongly acid; abrupt, smooth boundary.

B&A—9 to 13 inches, the B part is pale-brown (10YR 6/3) clay loam; many, medium, distinct, grayish-brown (10YR 5/2), dark yellowish-brown (10YR 4/4), and strong-brown (7.5YR 5/6) mottles; weak, medium, prismatic structure separating to moderate, medium, angular blocky structure; friable; all prismatic faces of peds have thin films of pale-brown (10YR 6/3) silt and very fine sand, A2 horizon materials and the interior blocky peds have only a few, thin, patchy films; the A part is pale-brown (10YR 6/3) loam; weak, medium, platy structure; very friable; occurs as the films on all the prismatic ped faces of the B part, and as a thin ½- to 1-inch, discontinuous layer below the Ap horizon that has a few ½-inch-wide tongues into the B part; 3 percent coarse fragments; strongly acid; clear, irregular boundary.

B21tg—13 to 21 inches, grayish-brown (2.5Y 5/2) heavy clay loam; common, fine, distinct, dark-brown (10 YR 4/3) and yellowish-brown (10YR 5/4) mottles; weak, medium, prismatic structure separating to moderate, medium, angular blocky structure; firm; thick clay films on all prismatic faces of peds and thin patchy clay films on most interior blocky faces of peds; some cracks and vertical surfaces have A2 films; ped centers have grayish-brown (10YR 5/2), yellowish-brown (10YR 5/6), and dark yellowish-brown (10YR 4/4) colors; 3 percent coarse fragments; medium acid; abrupt, wavy boundary.

B22tg—21 to 31 inches, grayish-brown (2.5Y 5/2) clay; many, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure separating to weak, medium and coarse, angular blocky structure; very firm; thick clay films on all prismatic and coarse blocky faces of peds, and thin clay films on interior blocky faces of peds, ped centers have dark-brown (10YR 4/3) and gray (10YR 5/1) colors; 3 percent coarse fragments; abrupt, wavy boundary.

C1g—31 to 45 inches, gray (5Y 5/1) heavy silty clay loam; many, fine, distinct, olive-brown (2.5Y 4/4) mottles; very weak, medium, prismatic structure breaking to very weak, coarse, angular blocky structure; firm; many, thick, gray (5Y 5/1) clay fillings and films in cracks and old root channels; 3 percent coarse fragments; calcareous; gradual, irregular boundary.

C2—45 to 62 inches, olive-brown (2.5Y 4/4) silty clay loam; many, fine, distinct, gray (10YR 5/1) mottles; weak, medium, platy structure grading to massive with depth; firm; many, thick, gray (5Y 5/1) clay fillings and flows in cracks and old root channels, many streaks and spots of light-gray (10YR 7/1) secondary lime; 3 percent coarse fragments; calcareous.

The solum is dominantly 22 to 35 inches thick but ranges from 20 to 45 inches in thickness. It ranges from strongly acid to slightly acid throughout the upper part and from medium acid to neutral throughout the lower part. Coarse fragments throughout the soil profile range from 3 to 15 percent gravel and are less than 1 to 3 percent cobblestones. The Ap horizon is dark grayish brown (10YR 4/2) or dark gray (10YR 4/1). It is loam or silt loam and ranges from 7 to 9 inches in thickness.

The B21tg horizon is dominantly grayish brown (2.5Y 5/2 or 10YR 5/2) and has common or many, dark-brown (10YR 4/3) and yellowish-brown (10YR 4/3) mottles, or the horizon is dark brown (10YR 4/3) and has many, grayish-brown (10YR 5/2 or 2.5Y 5/2), yellowish-brown (10YR 5/4 and 5/6), and dark grayish-brown (10YR 4/2) mottles. The B21tg horizon ranges from clay loam to heavy silty clay loam. The clay content ranges from 35 to 40 percent. The B21tg horizon has weak or moderate, medium, angular blocky structure. In a few profiles, the prismatic structure is absent in the B21tg horizon. The B22tg horizon is dominantly grayish brown (2.5 5/2 or 10YR 5/2) and has yellowish-brown (10YR 5/6) mottles. The center of the peds of the B22tg horizon is dark brown (10YR 4/3) or dark brown (10YR 4/3) mottled with gray (10YR 5/3), grayish brown (10YR 5/2 or 2.5Y 5/2), and yellowish brown (10YR 5/6). The B22tg horizon ranges from clay loam and silty clay loam to clay or silty clay. The clay content ranges from 35 to 45 percent.

The C horizon is typically gray (5Y 5/1) and has olive-brown (2.5Y 4/4) mottles, is olive brown (2.5Y 4/4) and has gray mottles (5Y 5/1), or is yellowish brown (10YR 5/4) and has gray (10YR 5/1) and grayish-brown (10YR 5/2) mottles. The C horizon is clay loam to silty clay loam.

Blount soils are similar in drainage to Pert, Conover, and Jeddo soils. The Blount soils have a thicker, more acid solum than the Pert soils. Blount soils have finer textured B horizons than the Conover and Londo soils. Although the Blount soils and the Parkhill and Sims soils developed in similar soil materials, the Blount soils have a lighter colored surface layer, are browner and less gray in the upper part of the subsoil, and have a lower natural water table than the Parkhill and Sims soils. Blount soils occur near areas of Morley and Jeddo soils. The Blount soils have a higher fluctuating water table and more gray mottles in the upper subsoil than the moderately well drained Morley soils. Blount and Jeddo soils developed in similar soil materials, but the Blount soils have a browner, less gray upper part of the subsoil than the Jeddo soils.

Blount loam, 0 to 2 percent slopes (BlA).—This somewhat poorly drained, level to nearly level soil occurs on the broad plains. The dominant slope is about 1 percent, and the areas range from 2 to 600 acres in size. Most of this soil occupies irregularly shaped, low, convex rises; long, uniform slopes; or broad, very slightly undulating areas. This soil has the profile described as typical for the series, but in some areas the depth to the limy underlying material varies greatly within short horizontal distances. Many spots are limy at less than 25 inches below the surface or at more than 40 inches. The surface layer is sandy loam in some areas, and in a few, small, scattered areas the plow layer is very dark grayish brown. In some areas the underlying till is variable and consists of heavy loam, heavy silt loam, or light silty clay.

Included with this soil in mapping are many small spots of poorly drained Parkhill loam that is in the slight depressions and narrow drainageways. In a few areas small spots of poorly drained Corunna sandy loam are included. Other inclusions are small, moundlike, sandy spots of Metamora sandy loam and Avoca loamy sand. A few small areas have slopes of 3 to 4 percent that generally border the major drainageways.

Wetness is the main limitation of this soil. This soil is well suited to most locally adapted crops, but it must be adequately drained. Most areas of this soil are farmed. Most wooded areas have second-growth stands of hardwoods, and many have been heavily pastured. Capability unit IIw–2 (1.5b); woodland group 3w1.

Blount loam, 2 to 6 percent slopes (BlB).—This somewhat poorly drained, gently sloping soil is on plains. The areas range from 2 to 200 acres in size. Most areas occur on domelike mounds, small knolls, long low ridges, or large undulating plains. Slopes are short and dominantly about 4 percent. The profile of this soil is similar to that described as typical for the series, but in some areas the depth to the limy underlying material varies greatly within short horizontal distances and many spots are limy at less than 25 inches below the surface.

Included with this soil in mapping are a few small spots of Blount soil that has a sandy loam surface layer. Also included are small areas of well drained and moderately well drained Morley loam and well drained Miami loam on the steeper slopes bordering major drainageways. A few spots that are moderately eroded are included, and in some spots the subsoil is exposed. Other inclusions are somewhat poorly drained Metamora sandy loam and Avoca loamy sand that occur on small caplike spots on the tops of mounds, knolls, and ridges. Poorly drained Parkhill loam occurs in many of the small depressions and drainageways. Many small, level inclusions are on the tops of rises and mounds, and there are a few areas of short slopes of more than 6 percent along drainageways.

Wetness and a moderate erosion hazard are the main limitations of this soil. Where drainage is adequate and proper erosion control practices are used, this soil is well suited to most locally adapted crops. Most areas are farmed. Wooded areas are in second-growth hardwoods. Capability unit IIw-3 (1.5b); woodland group 3w1.

Borrow Pits

Borrow pits (Bp) are areas that have been excavated and the upper part of the original soil removed. The soil materials borrowed from these areas range from organic muck and peat to sand or clay. In some places it is difficult to determine the kinds of materials that were borrowed. These excavated areas range from 1-acre pits to areas of about 100 acres. They are 1 or 2 feet to about 45 feet deep. Most areas are large, steep-sided trenches or pits. In some areas old sandy or gravelly beach ridges have had the higher center parts dug out, and rough, jagged remnants of the old side slopes remain. A few sandy knolls or knob-like hills have been completely removed, and only a slightly concave or dish-shaped excavation scar is left. In several areas there are huge, deep pits where clayey materials have been removed.

Borrow pits generally are raw and bare of vegetation, or they have only a sparse cover of weeds and brush. Erosion by both water and wind is a hazard. Many of these excavated areas are filled or partly filled with ponded water during wet periods. Some of the borrow areas were dug in soils that have a high water table, and they now have permanent high water levels.

Borrow areas are severely limited for most uses because of their poor soil condition and lower or dug-out positions in the landscape. In sandy areas the hazard of soil blowing is severe. In these areas the steep, exposed side slopes of the large, deep pits are subject to sloughing, landslides, and gully erosion. Most of these areas are unsuited to cultivated crops, but some areas can be reclaimed and used for hay and pasture if good grasses and legumes are properly established. Some of the wetter areas have potential for wildlife and recreational uses. Capability unit and woodland group not assigned.

Boyer Series

The Boyer series consists of nearly level to gently sloping, well-drained soils. These soils formed in 24 to 40 inches of loamy sand and sandy loam over calcareous sand and gravel. They occur on low narrow ridges and small mounds, in glacial drainageways, and on glacial lake beaches and outwash plains.

In a typical profile (fig. 6) the surface layer is dark grayish-brown loamy sand 10 inches thick. The subsoil is 28 inches thick and is divided into four layers. The upper two layers are brown and dark-brown, very friable loamy sand 12 inches thick. The third layer is dark-brown, friable heavy sandy loam 7 inches thick. The fourth layer is dark-brown, very friable loamy sand 9 inches thick. The limy underlying material is grayish-brown sand that contains a small amount of gravel.

Surface runoff is slow to medium. Permeability is moderately rapid, and the available water capacity is low.

***Figure 6.*—Profile of Boyer loamy sand, 2 to 6 percent slopes. The vertical black streak is a shadow cast by the measuring tape.**

Areas of these soils are not extensive or important to farming. They are of minor importance as a source of sand and gravel. Boyer soils have few limitations for nonfarm uses.

In St. Clair County the Boyer soils were mapped alone and also in a complex with the Wasepi soils. In this complex the Boyer soils are underlain by loamy materials at a depth ranging from 42 to 66 inches.

Typical profile of Boyer loamy sand, 2 to 6 percent slopes, in an alfalfa field, SE¼NW¼NW¼SE¼ sec. 30, T. 8 N., R. 16 E., about 400 feet south of the Hewitt Road:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) loamy sand; very weak, fine, granular structure; very friable; medium acid; abrupt, smooth boundary.

B1—10 to 17 inches, brown (7.5YR 5/4) light loamy sand; very weak, fine, subangular blocky structure; very friable; 1 percent gravel; slightly acid; clear, wavy boundary.

B21—17 to 22 inches, dark-brown (7.5YR 4/4) light loamy sand; very weak, medium, subangular blocky structure; very friable; 7 to 12 percent gravel and 1 to 3 percent cobblestones; slightly acid; abrupt, wavy boundary.

B22t—22 to 29 inches, dark-brown (7.5YR 4/4) heavy sandy loam; weak, medium and coarse, subangular blocky structure; friable; 10 to 18 percent gravel and 1 to 3 percent cobblestones; thin, patchy, dark-brown (7.5YR 4/2) clay films on faces of peds and bridged sand grains; slightly acid; abrupt, irregular boundary.

B23—29 to 38 inches, dark-brown (7.5YR 4/4) heavy loamy sand; very weak, medium, subangular blocky structure; very friable; 5 to 7 percent gravel and 1 to 3 percent cobblestones; neutral; abrupt, irregular boundary.

IIC—38 to 62 inches, grayish-brown (10YR 5/2) sand; single grain; loose; 5 to 7 percent gravel; calcareous.

Thickness of the solum ranges from 24 to 40 inches, but it is dominantly 25 to 36 inches. The Ap horizon is 4 to 10 inches thick and is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2). In a few profiles an A2 horizon is present. Where it is present, it is a yellowish-brown (10YR 5/4) or brown (10YR 5/3 or 7.5YR 5/4) loamy sand.

The B21 horizon is absent in a few profiles. The B22t horizon is heavy loamy sand, sandy loam, and heavy sandy loam. The B horizons contain 1 to 15 percent gravel and 1 to 5 percent cobblestones. These horizons range from strongly acid to slightly acid throughout the upper part and from slightly acid to mildly alkaline throughout the lower part. The B23 horizon is absent in a few profiles. The IIC horizon is sand, coarse sand, gravelly sand, and gravel.

Boyer soils are similar to the Spinks, Rousseau, Wasepi, Dighton, and Metea soils. Boyer soils have a finer textured and more compact Bt horizon than the Spinks soils. The subsoil of Boyer soils is finer textured than that of Rousseau soils and contains more coarse materials. Boyer soils lack the gray mottles in the upper part of the subsoil and the dark surface layer of the Wasepi soils. They are similar to Dighton and Metea soils in drainage. The subsoil of Boyer soils is coarser textured than that of Dighton soils. The subsoil of Boyer soils is finer textured than that of Metea soils, which are underlain by loamy materials at a depth of 18 to 40 inches.

Boyer loamy sand, 2 to 6 percent slopes (BrB).—This well-drained soil is on low ridges and domelike mounds. It occupies old lake beaches, plains, and terraces along large drainageways. The slopes are short, convex, and dominantly 4 or 5 percent. Areas of this soil range from 2 to about 60 acres in size and normally are longer than they are wide.

Included around the outer edges of some areas of this mapping unit are small spots and narrow strips that are underlain at a depth of 30 to 60 inches by loamy materials. Small, short areas that are strongly sloping and moderately eroded also are included.

The low natural fertility, low available water capacity, and moderate erosion hazard are the major limitations of this soil. Most areas of this soil are too narrow and oddly shaped for farming use. The cleared areas have been used mostly for pasture, and many areas have small gravel pits. This soil is moderately suited to small fruit, orchard fruit, and other specialty crops. Wooded areas are mostly in second-growth hardwoods. Capability unit IIIs-4 (4a); woodland group 3s1.

Chelsea Series

The Chelsea series consists of nearly level to gently sloping, well-drained soils. These soils formed in sand and loamy sand glacial drift. They occur on glacial-lake beaches, outwash plains, and lake plains.

In a typical profile the surface layer is dark grayish-brown sand 8 inches thick. The subsoil is 54 inches thick and consists of layers of sand and discontinuous lenses or layers of loamy sand. The upper 28 inches of the subsoil is strong-brown, yellowish-brown, and pale-brown, very friable and loose sand. The first very friable loamy sand layers start at a depth of 36 inches. They are 1/8 to 1 inch thick and alternate with thicker layers of pale-brown, loose sand. Both the sand and loamy sand layers have many, small, faint, yellowish-brown and strong-brown mottles. Below a depth of 49 inches, the loose sand layers are light brownish gray, and the very friable loamy sand layers are mottled yellowish brown.

Surface runoff is slow, and permeability is rapid. The available water capacity is low.

Chelsea soils are poorly suited to farming. They are better suited to reforestation, Christmas tree plantations, and recreation uses. Chelsea soils are among the better soils in the county for building sites.

In St. Clair County the Chelsea soils were mapped only in a complex with the Croswell soils.

Typical profile of Chelsea sand in an area of Chelsea-Croswell sands, 0 to 6 percent slopes, in an idle cultivated field, NW1/4SW1/4NE1/4 sec. 31, T. 7 N., R. 17 E., about 150 feet east of Range Road and 200 feet south of Atkins Road:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) sand; very weak, very fine, subangular blocky structure; very friable; medium acid; abrupt, smooth boundary.

B21—8 to 13 inches, strong-brown (7.5YR 5/6) sand; very weak, medium, subangular blocky structure; very friable; slightly acid; clear, wavy boundary.

B22—13 to 24 inches, yellowish-brown (10YR 5/6) sand; very weak, medium, subangular blocky structure to single grain; very friable to loose; slightly acid; abrupt, wavy boundary.

A2—24 to 36 inches, pale-brown (10YR 6/3) sand; single grain; loose; medium acid; abrupt, broken boundary.

B&A—36 to 49 inches, B part, dark-brown (7.5YR 4/4) light loamy sand; common, fine, faint, strong-brown (7.5YR 5/6) mottles; very weak, medium, subangular blocky structure; very friable; occurs as a series of discontinous lenses that are 1 inch thick or less and have thin, clay-bridged and -coated sand grains; medium acid; A part, pale-brown (10YR 6/3) sand; many, fine, distinct, yellowish-brown (10YR 5/6, 5/8) mottles; single grain; loose; medium acid; abrupt, broken boundary.

A'2—49 to 53 inches, light brownish-gray (10YR 6/2) sand; single grain; loose; medium acid; abrupt, wavy boundary.

B'2t—53 to 62 inches, yellowish-brown (10YR 5/4) light loamy sand; many, fine, faint, pale-brown (10YR 6/3), light brownish-gray (10YR 6/2), and yellowish-brown (10YR 5/6) mottles; very weak, medium, subangular blocky structure; very friable; sand grains are very thinly coated with clay and iron; medium acid.

Thickness of the solum is dominantly more than 50 inches, but it ranges from 40 to more than 70 inches. Reaction throughout the solum ranges from medium acid to neutral. The Ap horizon ranges from 4 to 10 inches in thickness. It is very dark grayish brown (10YR 3/2) and dark grayish brown 10YR 4/2) and is light loamy sand or sand. In undisturbed areas a black (10YR 2/1) A1 horizon, 2 to 4 inches thick, is common.

The B21 horizon is yellowish brown (10YR 5/4, 5/6, or 5/8), strong brown (7.5YR 5/6), or dark yellowish brown (10YR 4/4). Depth to the B in the B&A horizon ranges from 30 to 44 inches. The B't horizon and the B part of the B&A horizon are dark brown (7.5YR 4/4 or 10YR 4/3), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4). The B't horizon and the B part of the B&A horizon range from 1/8 to 5 inches in thickness, and they are discontinuous in short horizontal distances. The total thickness of all the B't horizon and the B part of the B&A horizon in the upper 60 inches of the profile does not exceed 6 inches. The B't horizon and the B part of the B&A horizon are loamy sand, loamy fine sand, or light sandy loam. The A'2 horizon and the A part of the B&A horizon are sand or fine sand.

Chelsea soils have drainage similar to that of the Boyer soils, but Chelsea soils have a thicker, less compact, coarser textured subsoil than Boyer soils and are not underlain by limy sand and gravel at a depth of 24 to 40 inches. Chelsea soils are similar to Croswell, Spinks, and Rousseau soils. The Chelsea soils have a thicker solum and finer textured layers than the Croswell soils. Chelsea soils have coarser texture than the Spinks soils in the uppermost 40 inches of the solum and have thinner loamy sand or sandy loam layers in the lower part of the solum. The loamy sand, loamy fine sand, and light sandy loam lenses, bands, or layers in the Chelsea soils are lacking in the Rousseau soils. Chelsea soils are similar to Wainola soils, but they developed in coarser sand than did the Wainola soils and are better drained. Also, Chelsea soils lack mottles in the upper part of the subsoil.

Chelsea-Croswell sands, 0 to 6 percent slopes (CcB).—This soil complex consists of well drained Chelsea sand and moderately well drained Croswell sand. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. They are nearly level to gently sloping and undulating. The dominant slope ranges from 2 to 3 percent. These areas have irregular and slightly convex shapes and range from 5 acres to 300 acres in size. Both soils have similar elevations and positions in the landscape. Each soil makes up about 45 percent of the complex. The soil profiles are those described as typical for the respective series.

Included with these soils in mapping are a few, small, pitlike depressions that have somewhat poorly drained Otisco loamy sand and Wainola loamy fine sand. Small areas of these included soils have underlying loamy materials at a depth of 42 to 62 inches. Small areas of moderately well drained sandy soils are included in the Chelsea part of the complex, and small areas of well drained sandy soils are included in the Croswell part.

Droughtiness and low fertility are the main limitations of these soils. Most areas were cleared and cultivated. Many areas have been reforested with pines, and some are used to produce Christmas trees. These soils are poorly suited as cropland. Erosion by both water and wind is a moderate hazard in cultivated areas. Capability unit IVs-4 (5a); Chelsea part in woodland group 3s1, Croswell part in woodland group 3s3.

Conover Series

The Conover series consists of nearly level to gently sloping, somewhat poorly drained soils that formed in limy loam glacial till. These soils occur on broad undulating till plains.

In a typical profile the surface layer is very dark grayish-brown loam 10 inches thick. The subsurface layer is yellowish-brown loam 9 inches thick. The yellowish-brown, firm clay loam subsoil is mottled with many gray, brown, and grayish-brown spots and is 7 inches thick. The limy heavy loam underlying materials have dominantly dark-brown colors that are mottled with spots of grayish brown, yellowish brown, and dark grayish brown.

Surface runoff is medium to slow. Permeability is moderately slow, and the available water capacity is high.

These soils are important to farming in the county. They are seasonally wet, and artificial drainage is needed for dependable cropping. Wetness of these soils limits many nonfarm uses.

In St. Clair County the Conover soils were mapped alone and also in a complex with the Parkhill soils.

Typical profile of Conover loam, 0 to 2 percent slopes, in a cultivated field, SW¼NW¼SW¼ sec. 33, T. 6 N., R. 13 E., about 1,300 feet south of Gould Road and 93 feet east of Capac Road Ditch:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) loam; very weak, fine, subangular blocky structure; friable; 1 percent coarse fragments; neutral; abrupt, smooth boundary.

A2—10 to 19 inches, yellowish-brown (10YR 5/4) loam; common, fine, faint, grayish-brown (10YR 5/2), dark-brown (10YR 4/3), and yellowish-brown (10 YR 5/6) mottles; very weak, medium, platy structure; very friable; many, dark-gray (10YR 4/1) worm casts; neutral; clear, wavy boundary.

B2t—19 to 26 inches, yellowish-brown (10YR 5/4) clay loam; many, fine, faint and distinct, yellowish-brown (10YR 5/6), gray (10YR 5/1), grayish-brown (10YR 5/2), and dark-brown (10YR 4/3) mottles; weak, medium, subangular blocky structure; firm; grayish-brown (10YR 5/2), thin clay films on all surfaces of peds; 1 percent coarse fragments; neutral; abrupt, irregular boundary.

C1—26 to 47 inches, dark-brown (10YR 4/3) heavy loam; many, fine, faint and distinct, grayish-brown (10YR 5/2), dark yellowish-brown (10YR 4/4), dark grayish-brown (10YR 4/2), and yellowish-brown (10YR 5/6) mottles; very weak, coarse, subangular blocky structure; firm; thin clay films along vertical faces of peds and cracks; 1 percent coarse fragments; calcareous; abrupt, irregular boundary.

C2—47 to 62 inches, yellowish-brown (10YR 5/4) heavy loam; many, medium, distinct, gray (10YR 5/1), light-gray (10YR 6/1), light olive-brown (2.5Y 5/4), and yellowish-brown (10YR 5/6) mottles; very weak, thick, platy structure grading to massive with depth; friable; few, thick, gray (10YR 5/1) clay fillings and flows in cracks; 1 percent coarse fragments; calcareous.

Thickness of the solum is dominantly 25 to 30 inches and ranges from 24 to 35 inches. Coarse fragments throughout the soil profile range from 2 to 12 percent gravel and 1 to 7 percent cobblestones. The Ap horizon is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1). It ranges from 7 to 10 inches in thickness and is dominantly loam.

The B horizon is dominantly yellowish brown (10YR 5/4), brown (10YR 5/3), or dark brown (10YR 4/3). Mottles are gray (10YR 5/1), grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), brown (10YR 5/3 and 4/3), and yellowish brown (10YR 5/4, 5/6, and 5/8). A few profiles have both B21 and B22t horizons, and a few have a B3 horizon below the Bt horizon. The B horizon is heavy loam, clay loam, and silty clay loam. The Bt horizon is 18 to less than 35 percent clay.

The C horizon is dominantly brown (10YR 5/3), dark brown (10YR 4/3), and yellowish brown (10YR 5/4 or 5/6). It is loam, silt loam, and light clay loam.

The Conover soils developed in materials similar to those of the Parkhill soils but have a browner, less dominantly gray subsoil and are better drained than the Parkhill soils. The drainage of the Conover soils is similar to that of the Londo and Blount soils. Conover soils have a thicker solum than that of the Londo soils and a coarser textured subsoil and underlying materials than the Blount soils.

Conover loam, 0 to 2 perent slopes (CvA).—This somewhat poorly drained soil occurs on small domelike mounds, low slightly convex rises, or broad plains that have a slight gradient. The dominant slope is about 1 percent, and the areas range from 2 to 600 acres in size. A profile of this soil is described as typical for the series, but the depth to the limy underlying material varies greatly in short horizontal distances and many spots are limy at a depth of less than 24 inches or more than 40 inches. In a few small areas, the plow layer is dark grayish brown, and in some small areas the underlying limy till ranges from sandy loam to silty clay loam.

Included with this soil in mapping, in most of the narrow drainageways and small depressions, are small areas of poorly drained Parkhill loam. Also included are a few spots of Avoca loamy sand and Metamora sandy loam.

Wetness is the main limitation of this soil. Where adequately drained, this soil is well suited to most locally adapted crops. Most areas are farmed because the soil is one of the best in the county for farming. Capability unit IIw-4 (2.5b); woodland group 3w1.

Conover loam, 2 to 6 percent slopes (CvB).—This somewhat poorly drained soil is gently sloping and undulating. The dominant slopes are 3 and 4 percent, and areas range from 2 to 160 acres in size. Many of the 2- to 10-acre areas occur as knolls, ridges, and long, narrow side slopes along minor drainageways. The larger areas of this soil form broad undulating plains that have many, short, complex slopes. The soil profile is similar to that described as typical for the series, except that the depth to the limy underlying materials varies greatly within short horizontal distances and that many spots are limy at a depth of less than 24 inches or more than 40 inches. In a few small areas, this soil has a dark grayish-brown plow layer, and in some areas the limy underlying till ranges from sandy loam to silty clay loam.

Included with this soil in mapping is poorly drained Parkhill loam in many of the narrow drainageways and small depressions. Also included in small, scattered, sandy spots on the tops of knolls or ridges are somewhat poorly drained Avoca loamy sand and Metamora sandy loam. Other inclusions are a few moderately eroded spots on the tops of areas where slopes are 4 to 5 percent.

Wetness and a moderate erosion hazard are the main limitations of this soil. Where artificial drainage is adequate and proper erosion control practices are used, this soil is well suited to most locally adapted crops. Most areas of this soil are farmed. The wooded areas are in second-growth hardwood stands. Capability unit IIw-5 (2.5b); woodland group 3w1.

Conover-Parkhill loams, 0 to 2 percent slopes (CwA).—This complex consists of somewhat poorly drained Conover loam and poorly drained Parkhill loam. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. This complex is nearly level to slightly undulating and occurs on broad plains that are generally 100 to 300 acres in size. Conover loam makes up about 50 percent of this complex and is on the higher, slightly convex mounds, knolls, and rises. Parkhill loam makes up about 40 percent of the complex and is in the lower, slightly concave depressions, drainageways, and flats.

Conover loam has a profile similar to that described for the series, but in some places the limy material is within 14 to 24 inches of the surface or ranges to below 40 inches. Parkhill loam has a profile similar to that described for the series, though in some places the thickness of the dark surface layer ranges to 14 inches.

Included with the Conover part of this mapping unit are a few areas where the surface layer is a sandy loam.

Included with the Parkhill part of this mapping unit are small areas where the limy underlying material has thin layers of very fine sandy loam to silty clay loam. Also included in this complex are somewhat poorly drained Metamora sandy loam and Avoca loamy sand in small spots on the tops of the mounds, knolls, and rises. Other inclusions are many small spots of poorly drained Corunna sandy loam and a few spots of poorly drained Lamson fine sandy loam. These included Metamora, Avoca, Corunna, and Lamson soils have profiles containing considerable sandy loam.

Most of this complex has been cleared and cultivated. A few wooded areas remain in stands of second-growth hardwoods. Wetness is the main limitation in the use of these soils. Where adequately drained, these soils are well suited to most locally adapted crops. Capability unit IIw-4 (2.5b, 2.5c); Conover part in woodland group 3w1, Parkhill part in woodland group 3w3.

Corunna Series

The Corunna series consists of nearly level, poorly drained soils. These soils formed in 20 to 40 inches of sandy loam over limy loam and clay loam glacial till. These soils are in small depressions and narrow drainageways of till plains.

In a typical profile the surface layer is very dark brown sandy loam 10 inches thick. The subsoil is friable sandy loam that is dark gray and grayish brown and has small spots and streaks of gray and yellowish brown. It is 21 inches thick. The limy underlying material is mainly dark grayish-brown and olive-brown clay loam and loam mixed with gray and yellowish-brown spots and streaks.

Surface runoff is very slow. Permeability is moderately rapid in the sandy upper part and moderately slow in the loamy lower part. The available water capacity is high.

With adequate drainage, these soils have a wide adaptability to local crops. Wetness severely limits many nonfarm uses.

Typical profile of Corunna sandy loam in an alfalfa field, NE¼SW¼ sec. 3, T. 5 N., R. 15 E., about 75 feet south of waterway in field next to Wales Center Road:

Ap—0 to 10 inches, very dark brown (10YR 2/2) sandy loam; weak, medium, granular structure; very friable; medium acid; abrupt, smooth boundary.

B21g—10 to 17 inches, dark-gray (10YR 4/1) heavy sandy loam; common, fine, faint, dark grayish-brown (10YR 4/2) mottles and common, fine, distinct, gray (10YR 5/1), yellowish-brown (10YR 5/6 and 5/8), and dark-brown (10YR 4/3) mottles; moderate, fine, subangular blocky structure; friable; thin clay films on most surfaces of peds and root channels; 5 to 7 percent gravel and 2 to 3 percent cobblestones; slightly acid; clear, wavy boundary.

B22g—17 to 22 inches, grayish-brown (10YR 5/2) heavy sandy loam; many, fine, faint and distinct, dark-gray (10YR 4/1), dark-brown (10YR 4/3), and yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; few, patchy, dark-gray (10YR 4/1) and dark grayish-brown (10YR 4/2) clay films along cracks and root channels and on surfaces of peds; neutral; clear, wavy boundary.

B23g—22 to 31 inches, grayish-brown (10YR 5/2) sandy loam; many, fine and medium, faint and distinct, dark-brown (10YR 4/3), dark grayish-brown (10YR 4/2), and yellowish-brown (10YR 5/6) mottles; very weak, medium, subangular blocky structure; friable; very few dark grayish-brown (10YR 4/2) clay flows along root channels and cracks; 10 to 15 percent gravel and 3 to 5 percent cobblestones; neutral; abrupt, wavy boundary.

IIC1g—31 to 34 inches, gray (10YR 5/1) light clay loam; many, fine and medium, distinct, yellowish-brown (10YR 5/6), dark-brown (10YR 4/3), and gray (N 5/0) mottles; massive; firm; 5 to 7 percent gravel and 2 to 3 percent cobblestones; mildly alkaline; abrupt, wavy boundary.

IIC2g—34 to 51 inches, dark grayish-brown (2.5Y 4/2) light clay loam; many, fine, distinct, olive-brown (2.5Y 4/4), gray (N 5/0), and olive-gray (5Y 5/2) mottles; massive; friable; calcareous.

IIC3g—51 to 56 inches, dark grayish-brown (2.5Y 4/2) heavy loam; common, fine, faint, olive-brown (2.5Y 4/4) and grayish-brown (2.5Y 5/2) mottles; massive; friable; calcareous.

The solum ranges from 20 to 40 inches in thickness but is dominantly 30 to 37 inches thick. The Ap horizon is very dark brown (10YR 2/2) or very dark gray (10YR 3/1). The matrix of the B21g horizon is dark gray (10YR 4/1) or gray (10YR 5/1). The B horizon ranges from sandy loam to fine sandy loam and light sandy clay loam. Coarse fragments in the B horizon range from 0 to 15 percent gravel and 0 to 12 percent cobblestones. The IIC1g horizon ranges from 1 to 8 inches in thickness. The C horizon ranges from loam and clay loam to silty clay loam. Coarse fragments in the C horizon range from 0 to 12 percent gravel and 0 to 3 percent cobblestones.

The surface layer of these soils is a few inches thinner than the defined range for the series, but this difference does not alter their usefulness and behavior.

Corunna soils occur on till plains near areas of Metamora, Parkhill, Conover, and Blount soils. The materials in which the Corunna soils developed are similar to those of the Metamora soils, but the Corunna soils are more poorly drained. They have a coarser textured B horizon than the Parkhill soils. The subsoil of Corunna soils is coarser textured than that of the Conover and Blount soils. Corunna and Gilford soils are similar in drainage, but Corunna soils have finer textured underlying materials at a depth of 24 to 40 inches than the Gilford soils.

Corunna sandy loam (0 to 2 percent slopes) (Cx).—This poorly drained soil is in slightly concave depressions, narrow and nearly level drainageways, and level areas. These areas range from 2 to 80 acres in size.

Included with this soil in mapping are many small spots where the underlying loamy material is more than 40 inches below the surface. Also included, in a few places near the soil boundaries, are narrow strips where the sandy loam upper part is less than 18 inches thick. Other inclusions are a few small spots of Parkhill loam that lacks the sandy loam upper part characteristic of Corunna sandy loam.

Many areas of this soil have been cleared and cultivated. The main limitation is wetness. Where adequately drained, this soil is well suited to most crops commonly grown in the county. The few remaining forested areas are covered with second-growth hardwoods. Capability unit IIw-8, (3/2c); woodland group 4w1.

Croswell Series

The Croswell series consists of nearly level to gently sloping, moderately well drained soils. These soils formed in deep sand deposits of glacial drift. They occur on glacial lake beaches, lake plains, and outwash plains.

In a typical profile the surface layer is very dark grayish-brown sand 7 inches thick. The subsoil is 24 inches thick and is divided into two layers. The upper layer is strong-brown, very friable sand 8 inches thick. The lower layer is 16 inches thick and is brown, loose sand that has many, small, strong-brown and dark-brown mottles. The underlying material is brown sand mottled with yellowish brown, pale brown, light brownish gray, and grayish brown.

Surface runoff is slow. Permeability is rapid, and available water capacity is low.

These soils are not important to farming. Woodland, recreation, and Christmas tree plantations are the main uses of Croswell soils. Accessible areas are used for homesites.

In St. Clair County the Croswell soils were mapped only in complexes with the Chelsea soils and with the Lamson soils.

Typical profile of Croswell sand from an area of Chelsea-Croswell sands, 0 to 6 percent slopes, in an old abandoned orchard, NW¼NW¼SE¼ sec. 31, T. 7 N., R. 17 E., 150 feet south of section center on Range Road and 78 feet east of road ditch:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) sand; very weak, fine, granular structure; very friable; few, irregular tongues along root channels; strongly acid; abrupt, smooth boundary.

B21hir—7 to 15 inches, strong-brown (7.5YR 5/6) sand; very weak, medium, subangular blocky structure; very friable; strongly acid; clear, wavy boundary.

B22ir—15 to 31 inches, brown (10YR 5/3) sand; many, fine and medium, distinct, strong-brown (7.5YR 5/6) and dark-brown (7.5YR 4/4) mottles; single grain; loose; many chunks and pellets of ortstein and small spots of iron accumulations that are ½ to 3 inches in diameter; medium acid; clear, wavy boundary.

C1—31 to 39 inches, brown (10YR 5/3) sand; many, medium, faint, yellowish-brown (10YR 5/4) and pale-brown (10YR 6/3) mottles; single grain; loose; few, small spots of iron accumulation; strongly acid; clear, wavy boundary.

C2—39 to 53 inches, brown (10YR 5/3) sand; many, fine, faint, grayish-brown (10YR 5/2) mottles; single grain; loose; medium acid; clear, wavy boundary.

C3—53 to 62 inches, brown (10YR 5/3) sand; many, fine, distinct, light brownish-gray (10YR 6/2) and grayish-brown (10YR 5/2) mottles; single grain; loose; medium acid.

Thickness of the solum is dominantly 20 to 40 inches, and the depth to calcareous materials ranges from about 40 to 66 inches. Reaction throughout the solum is strongly acid to medium acid. Depth to drainage mottles ranges from 20 to 45 inches.

The A horizon is sand or loamy sand. The Ap horizon is mostly very dark grayish brown (10YR 3/2) and ranges from 7 to 10 inches in thickness. In undisturbed or forested areas, there is a black (10YR 2/1) A1 horizon 2 to 5 inches thick. A few profiles have a grayish-brown (10YR 5/2) A2 horizon 1 to 3 inches thick.

The B and C horizons dominantly are sand, but a few fine sand and loamy sand layers are present in a few profiles. The B21hir horizon is mainly strong brown (7.5YR 5/6), dark brown (7.5YR 4/4 or 10YR 4/3), or dark yellowish brown (10YR 4/4). The B22ir horizon is mainly strong brown (7.5YR 5/6), yellowish brown (10YR 5/4 or 5/6), and brown (10YR 5/3 or 7.5YR 5/4). The B horizon has pellets and small pieces of weakly cemented ortstein or spots of iron accumulation in a few profiles. The B22ir horizon or C1 horizon has mottles that are mainly strong brown (7.5YR 5/6 and 5/8), brown (10YR 5/3 or 7.5YR 4/4 and 5/4), yellowish brown (10YR 5/4, 5/6, and 5/8), or pale brown (10YR 6/3). Mottles of grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) normally start below depths of 30 inches.

The C horizon is dominantly brown (10YR 5/3), pale brown (10YR 6/3), or yellowish brown (10YR 5/4 or 5/6). In a few profiles the lower C horizon has thin layers containing 1 to 10 percent gravel.

Mottles in the subsoil (Bhir and Bir horizons) of these soils are not defined in the range for the series, but this difference does not alter usefulness and behavior of the soils.

Croswell soils are similar to Eastport, Rousseau, Chelsea, and Spinks soils. Croswell soils have a more acid solum and darker layers in the upper part of the subsoil than Eastport soils. They developed in coarser sand materials than the Rousseau soils and have a slightly higher water table. Croswell soils are dominantly deep sand, and they lack the thin loamy sand lenses and layers of the Chelsea and Spinks soils.

Croswell-Lamson complex, 0 to 6 percent slopes (CyB).—This complex consists of moderately well drained Croswell sand and poorly drained Lamson fine sandy loam. Croswell sand makes up about 50 to 70 percent of this complex and occurs in the gently sloping and undulating, higher areas. Lamson fine sandy loam makes up the remaining 20 to 40 percent of the complex and occurs in the lower areas and depressions. Areas of this complex range from 20 to 100 acres in size. Slopes of the Croswell sand are short, mainly convex, and dominantly 3 to 4 percent. Lamson fine sandy loam is level or has slightly concave slopes, and the dominant slope range is 0 to 1 percent. The profiles of these soils are similar to those described for each series.

Included with this complex in mapping, in a few areas of Croswell and Lamson soils, are soils that are underlain by clay at a depth of 48 to 60 inches. Also included in Croswell sand areas are small spots of well-drained Spinks loamy sand. Other inclusions are small areas of well-drained Rousseau fine sand in Croswell sand areas.

The wetness of Lamson fine sandy loam and the droughtiness and low fertility of Croswell sand are the chief limitations of this complex. In cultivated areas of Croswell sand, soil blowing is a moderate hazard. These soils are poorly suited to farming. The intricate soils pattern of this complex and its undulating topography make farming difficult, and most areas are still forested. Capability unit IVs–4 (5a, 3c); Croswell part in woodland group 3s3, Lamson part in woodland group 4w1.

Deford Series

The Deford series consists of nearly level, very poorly drained soils. These soils formed in water-laid fine sand deposits. They occur on slightly depressed flats and in small basinlike depressions of glacial lake beaches, outwash plains, and deltas.

In a typical profile the surface layer is black fine sand 9 inches thick. The gray and dark-gray subsoil is 24 inches thick and consists of two layers of loose fine sand and one layer of loose sand. The underlying material is layered, gray fine sand.

Surface runoff is very slow or ponded. Permeability is rapid, and available water capacity is low.

Because these soils are wet and low in natural fertility, only a few areas are used for farming. Wetness severely limits these soils for many nonfarm uses.

Typical profile of Deford fine sand in an area of Wainola-Deford fine sands, 0 to 2 percent slopes, in an idle cultivated field, NW¼SW¼SW¼ sec. 20, T. 7 N., R. 17 E., about 280 feet east of State Road and 190 feet south of old east-west fence line:

Ap—0 to 9 inches, black (10YR 2/1) fine sand; very weak, fine, subangular blocky structure; very friable; slightly acid; abrupt, smooth boundary.

B21g—9 to 19 inches, gray (10YR 5/1) fine sand; common, fine, faint, dark-gray (10YR 4/1), and grayish-brown (10YR 5/2) mottles; single grain; loose; neutral; abrupt, smooth boundary.

B22g—19 to 26 inches, gray (5Y 5/1) sand; single grain; loose; neutral; abrupt, smooth boundary.

B23g—26 to 33 inches, dark-gray (5Y 4/1) fine sand; many, medium and coarse, distinct, dark yellowish-brown (10YR 4/4) and grayish-brown (2.5Y 5/2) mottles; single grain; loose; neutral; abrupt, wavy boundary.

C1g—33 to 49 inches, gray (5Y 5/1) fine sand; common, fine, distinct, olive-brown (2.5Y 4/4) mottles; single grain; loose; mildly alkaline; gradual, wavy boundary.

C2g—49 to 62 inches, gray (5Y 5/1) fine sand; single grain; loose; calcareous.

The solum is dominantly 34 to 64 inches thick, but it ranges from 25 to more than 64 inches in thickness. It ranges from medium acid to neutral. The Ap horizon ranges from 6 to 10 inches in thickness, but it is mainly 8 to 10 inches thick. It is very dark brown (10YR 2/2), black (10YR 2/1), or very dark gray (10YR 3/1). The Ap horizon is fine sand, loamy fine sand, or loamy sand.

Dominant colors of the B horizon are dark grayish brown (2.5Y 4/2), gray (10YR 5/1 or 5Y 5/1), and dark gray (10YR 4/1 or 5Y 4/1). The B horizon is dominantly fine sand. It has one or more layers of sand, however, and it ranges to loamy fine sand and loamy sand.

The matrix colors of the C horizon are mainly gray (10YR 5/1 or 5Y 5/1) or dark gray (10YR 4/1 or 5Y 4/1). The C horizon is mainly fine sand and a few layers of sand or loamy fine sand. It ranges from neutral to moderately alkaline (calcareous).

Deford soils are similar to Tobico, Lamson, Wainola, Bach, and Pinconning soils. Deford soils have calcareous soil material at a greater depth than Tobico soils. The subsoil and underlying material of Deford soils are coarser textured than those of Lamson soils. Deford soils formed in material similar to that of Wainola soils but are wetter and have a grayer subsoil. The drainage of Deford soils is similar to that of Bach and Pinconning soils. Deford soils have a coarser textured subsoil than Bach soils and calcareous soil material at a greater depth. Deford soils are deep and sandy and are not underlain by clay at a depth of 18 to 40 inches as are the Pinconning soils.

Deford fine sand (0 to 2 percent slopes) (De).—This very poorly drained soil occurs in small, slightly concave depressions, in narrow drainageways, and on broad, depressed flats. This soil also occurs in broad drainageways that are longer than they are wide. Areas of this soil range from 2 to about 50 acres in size.

Included with this soil in mapping are small areas of somewhat poorly drained Minoa fine sandy loam and Wainola loamy fine sand. Also included are small areas that are underlain by loamy materials at a depth of 30 to 50 inches. Other inclusions are areas that are 1 to 2 acres in size and have an organic surface layer 10 to 15 inches thick.

Wetness, low natural fertility, and the fine sand are the major limitations of this soil. Drainage is difficult to establish and maintain. The fine sand tends to flow when wet, and ditchbanks slough and tile lines are plugged. Because this soil has low available water capacity, it becomes droughty in midsummer when the water table lowers.

This soil is moderately suited to most locally adapted crops. Many areas are not farmed. Capability unit IIIw–6 (4c); woodland group 4w1.

Dighton Series

The Dighton series consist of nearly level to gently sloping, well-drained soils. These soils formed in 20 to 40 inches of loamy till materials and underlying fine sand and sand. The occur in undulating areas on moraines.

In a typical profile the surface layer is dark grayish-brown sandy loam 8 inches thick. The upper 10 inches of the dark-brown, firm clay loam subsoil is mixed with the remaining parts of a yellowish-brown sandy loam subsurface layer. The middle 11 inches of the subsoil is dark-brown, firm clay loam, and the lower 7 inches is yellowish-brown, friable fine sandy loam. The underlying material is stratified, brown fine sand and dark yellowish-brown loamy fine sand. The fine sand material starts at a depth of 36 inches and extends to 55 inches. Brown sand occurs below a depth of 55 inches. The underlying sandy layers are medium acid.

Surface runoff is slow to medium. Permeability is moderate in the loamy upper part of the profile and very rapid in the sandy underlying material. Available water capacity is moderate. These soils are of small extent, but they are important to farming. Some deep deposits of gravel are associated with the underlying materials of these soils. Dighton soils have few limitations for nonfarm uses.

In St. Clair County the Dighton soils were mapped only in complexes with the Miami soils.

Typical profile of Dighton sandy loam in an area of Miami-Dighton sandy loams, 2 to 6 percent slopes, in a cultivated field, SW¼SE¼SE¼SE¼ sec. 7, T. 8 N., R. 15 E., about 100 feet north of road ditch:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine, subangular blocky structure; very friable; 1 percent coarse fragments; medium acid; abrupt, smooth boundary.

B&A—8 to 18 inches, A part, yellowish-brown (10YR 5/4) sandy loam; moderate, thin, platy structure; very friable; occurs as a thin, discontinuous A2 layer that has an irregular lower boundary and a few tongues that are 1 inch to 3 inches wide, and as coatings of A2 materials on all ped faces of the B part; B part, dark-brown (10YR 4/3) light clay loam; moderate, medium, subangular blocky structure; firm; 1 percent coarse fragments; medium acid; clear, wavy boundary.

B2t—18 to 29 inches, dark-brown (10YR 4/3) clay loam; moderate, medium and coarse, angular blocky structure; firm; very thin clay films on most surfaces of peds and along root channels; 1 percent coarse fragments; medium acid; abrupt, wavy boundary.

B3—29 to 36 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, thick, platy structure; friable; 1 percent coarse fragments; strongly acid; abrupt, irregular boundary.

IIC1—36 to 55 inches, stratified, brown (10YR 5/3) fine sand and dark yellowish-brown (10YR 4/4) light loamy fine sand; single grain or massive; loose or very friable; medium acid; gradual, irregular boundary.

IIC2—55 to 64 inches, brown (10YR 5/3) sand; single grain; loose; medium acid.

Depth to the IIC horizon is dominantly 30 to 40 inches but ranges from 24 to 40 inches. The loamy solum ranges from strongly acid to slightly acid throughout the uper part and strongly acid to moderately alkaline (calcareous) throughout the lower part. Coarse fragments in the loamy part of the soil profile range from 1 to 6 percent gravel and from 1 to 4 percent cobblestones. The Ap horizon is 6 to 8 inches thick and is dark grayish brown (10YR 4/2) and dark brown (10YR 4/3). It is sandy loam or fine sandy loam. In a few profiles, an A2 or A&B horizon occurs. The A2 part is yellowish-brown (10YR 5/4) or brown (10YR 5/3 or 7.5YR 5/4) fine sandy loam or sandy loam.

Dominantly the profile has a B&A horizon, but in a few profiles this horizon is an A&B horizon. The B&A horizon is yellowish brown (10YR 5/4), brown (10YR 5/3 or 7.5YR 5/4), dark brown (10YR 4/3), or dark yellowish brown (10YR 4/4). The B2t horizon is dark brown (10YR 4/3 or 7.5YR 4/4). It is light clay loam, clay loam, heavy clay loam, silty clay loam, and light silty clay. The B2t horizon averages between 35 and 45 percent clay but dominantly is about 38 percent. The B3 horizon is absent in a few profiles. Where present, the B3 horizon is yellowish brown (10YR 5/4), dark brown (7.5YR 4/4 or 10YR 4/3), or brown (10YR 5/3 or 7.5YR 5/4) and is fine sandy loam or loam.

The IIC1 horizon is fine sand and sand that are brown (10YR 5/3), yellowish brown (10YR 5/4), or light yellowish brown (10YR 6/4). The loamy sand or light loamy fine sand layers of the IIC1 horizon are dark brown (10YR 4/3 or 7.5YR 4/4) or dark yellowish brown (10YR 4/4). In a few profiles the IIC1 horizon is up to several feet thick, but in others it is absent. The IIC2 horizon is brown (10YR 5/3) sand or fine sand. It ranges from medium acid to moderately alkaline (calcareous).

Dighton soils occur near areas of Miami, Morley, Metamora, Metea, and Conover soils. At a depth of 24 to 40 inches, Dighton soils are underlain with coarser textured materials than Miami or Morley soils. Dighton soils have a less gray subsoil and coarser textured underlying materials than the Metamora soils. Dighton soils have a finer textured surface layer and subsoil than Metea soils and coarser textured underlying materials. They differ from Conover soils in lacking mottles in the subsoil and in having coarser textured underlying materials.

Eastport Series

The Eastport series consists of nearly level to strongly sloping, well-drained soils. These soils formed in deep sand on glacial lake beaches. These old lake beaches are slightly inland, and they parallel the present shore of Lake Huron.

In a typical profile (fig. 7) the surface layer is very dark grayish brown sand 7 inches thick. The subsoil is loose sand 17 inches thick. The upper part of the subsoil is dark yellowish brown, and the lower parts are strong brown and yellowish brown. The subsoil is 5 to 20 percent fine gravel. The underlying material is brown sand, is neutral, and contains from 2 to 20 percent gravel.

Surface runoff is very slow to medium. Permeability is very rapid, and the available water capacity is very low. These soils have little importance to farming, but they are important as a source of sand for construction purposes. They also are important for recreation and as building sites.

Typical profile of Eastport sand, 0 to 6 percent slopes, in a pine plantation, NE¼NE¼SE¼SE¼ sec. 6, T. 8 N., R. 17 E., about 450 feet east of U.S. Highway No. 25:

Ap—0 to 7 inches, very dark grayish brown (10YR 3/2) sand; single grain; loose; 5 to 7 percent fine gravel; strongly acid; abrupt, smooth boundary.

B21hir—7 to 9 inches, dark yellowish-brown (10YR 4/4) sand; single grain; loose; 5 to 7 percent fine gravel; slightly acid; abrupt, irregular boundary.

B22ir—9 to 14 inches, strong-brown (7.5YR 5/6) sand; single grain; loose; 10 to 20 percent fine gravel; slightly acid; clear, wavy boundary.

B23ir—14 to 24 inches, yellowish-brown (10YR 5/6) sand; single grain; loose; 5 to 7 percent fine gravel; neutral; clear, wavy boundary.

C1—24 to 42 inches, brown (10YR 5/3) sand; single grain; loose; 2 to 3 percent fine gravel; neutral; abrupt, wavy boundary.

C2—42 to 62 inches, brown (10YR 5/3) sand; single grain; loose; 10 to 15 percent gravel; neutral.

The solum ranges from 16 to 28 inches in thickness. Depth to calcareous material ranges from 16 to more than 76 inches. The Ap horizon ranges from 4 to 7 inches in thickness. It is very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) to very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2). The Ap horizon is sand and is very strongly acid to medium acid.

The B21hir is dark yellowish brown (10YR 4/4), dark brown (10YR 4/3 or 7.5YR 4/4), or brown (10YR 5/3 or 7.5YR 5/4). The B22ir and B23ir horizons are strong brown (7.5YR 5/6), brown (7.5YR 5/4), or yellowish brown (10YR 5/6). The B horizon is medium acid to slightly acid throughout the upper part and is slightly acid to neutral throughout the lower part. Coarse fragments throughout the B horizon range from 1 to

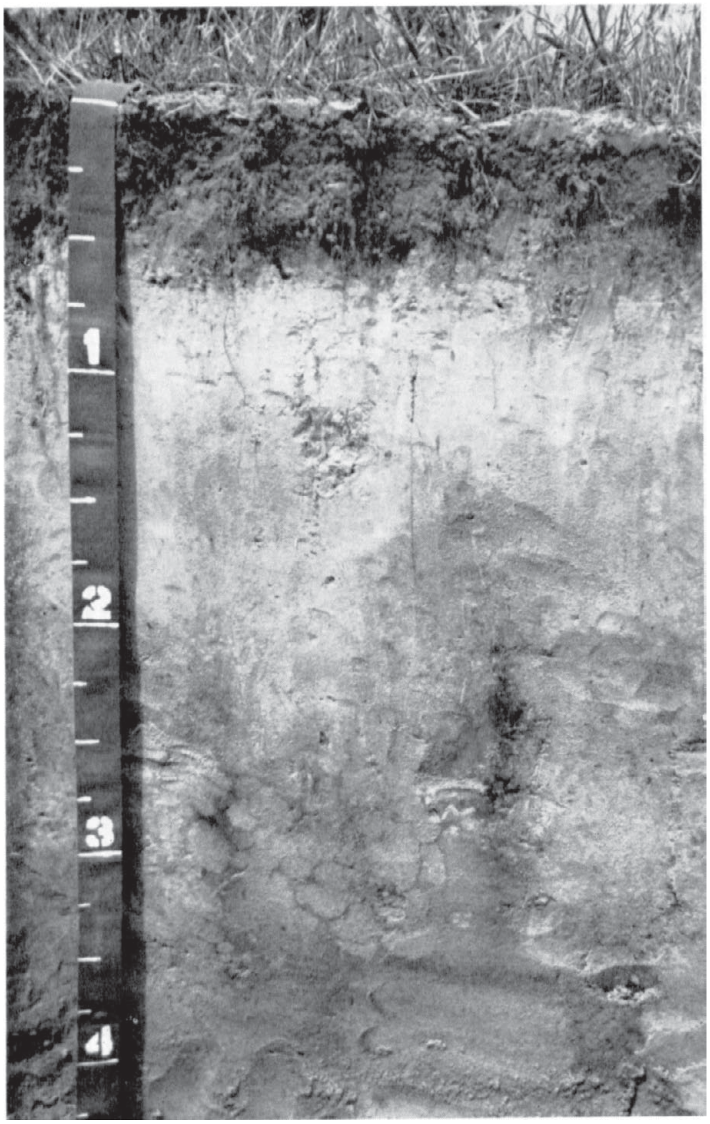

Figure 7.—**Profile of Eastport sand, 0 to 6 percent slopes. The profile is not well developed.**

15 percent gravel and are contrastingly variable from layer to layer in the horizon.

The C horizon is brown (10YR 5/3), pale brown (10YR 6/3), or yellowish brown (10YR 5/4). It is sand, coarse sand, very coarse sand, gravel, or sand mixed with 1 to 15 percent of gravel. Texture and the content of gravel of the C horizon are contrastingly variable from one layer to another. In many profiles the total amount of gravel is concentrated in one or two thin horizons in the C horizon. The C horizon ranges from slightly acid to mildly alkaline (calcareous).

These soils are outside the range for the series in that they lack a subsurface layer (A2 horizon), but this difference does not alter the usefulness of these soils.

Eastport soils are similar to Rousseau, Chelsea, Spinks, and Croswell soils. Eastport soils developed in sand that contains gravel, but Rousseau soils developed in fine sand without gravel. Eastport soils lack the finer textured layers and lenses of Chelsea and Spinks soils. The subsoil of Eastport soils is less acid and contains more gravel and coarse fragments than the subsoil of Croswell soils. Eastport soils occur near Wainola soils. They lack the mottles of Wainola soils and the dominantly fine sand subsoil and stratified fine sand underlying materials.

Eastport sand, 0 to 6 percent slopes (EaB).—This soil occupies old lake beaches. These areas border the present shoreline of Lake Huron, or they are slightly inland and parallel to it. The areas range from 2 to 200 acres in size. They occur as single, low, narrow ridges or as broad areas that have corrugated ridges and troughs and surface relief that is oriented in a general north-south direction. A profile of this soil is described as typical for the series.

Included with this soil in mapping are a few small areas of somewhat poorly drained Wainola loamy fine sand and very poorly drained Tobico mucky fine sand. Also included are a few short slopes of 7 to 9 percent. Other inclusions are areas where there are a few severely eroded spots caused mainly by wind.

This soil is not suited to intensive farming. A moderate erosion hazard, low natural fertility, and very low available water capacity are serious limitations. The demand for areas of this soil for recreation uses, and as sites for commercial and domestic buildings, is rapidly increasing, mainly because the areas are near Lake Huron. Areas of this soil have been used for a long time as a source of sand for construction purposes, and many sand pits and borrow pits are in these areas. Capability unit VIIs-1 (5.3a); woodland group 3s3.

Eastport sand, 6 to 18 percent slopes (EaC).—This well-drained soil occupies the old beach ridges that border the present shoreline of Lake Huron or are slightly inland and parallel to it. The soil occurs in single narrow ridges, on a broad series of ridges, and in troughs. The ridges are convex and are 150 feet to about 2 miles long and 100 to about 450 feet wide. The troughs are slightly concave and about 25 to 75 feet wide. The ridge and trough areas have a width ranging from 300 to about 1,500 feet. The soil profile is similar to that described for the series, except that in strongly sloping areas the profile of this soil has less gravel.

Included with this soil in mapping are small spots that have short steep slopes. Also included are somewhat poorly drained Wainola loamy fine sand and very poorly drained Tobico mucky fine sand on the bottom of some of the deeper troughs and depressions.

This Eastport soil is not suited to intensive farming or to the production of timber. The erosion hazard is moderately severe to severe, natural fertility is low, and available water capacity is very low. Many areas of this soil have been used a source of sand for construction purposes, and these areas contain many sand pits and borrow pits. Areas of this soil are used for recreation and as sites for commercial and domestic buildings. Capability unit VIIs-1 (5.3a); woodland group 3s3.

Gilford Series

The Gilford series consists of nearly level, poorly drained soils. These soils formed in 24 to 40 inches of sandy loam and loamy sand over limy coarse sand. They occur in low, level or nearly level areas, in slightly concave depressions in outwash plains, and in glacial drainageways.

In a typical profile the surface layer is very dark gray sandy loam 10 inches thick. The subsoil is gray sandy loam and loamy sand that has many, small, dark-brown, yellowish-brown, grayish-brown, dark-gray, and light olive-brown spots. It is 26 inches thick and very friable to friable. The limy underlying material is gray coarse sand.

Surface runoff is very slow to ponded. Permeability is moderately rapid, and available water capacity is low. These soils are of small extent in the county and are relatively unimportant to farming. Wetness severely limits many nonfarm uses of these soils.

Typical profile of Gilford sandy loam in a cultivated field, NW¼SE¼SW¼SW¼ sec. 13, T. 7 N., R. 15 E., about 450 feet north of Imlay City Road:

Ap—0 to 10 inches, very dark gray (10YR 3/1) sandy loam; weak, medium and coarse, granular structure; very friable; neutral; abrupt, smooth boundary.

B21g—10 to 18 inches, gray (10YR 5/1) light sandy loam; common, fine, distinct, dark-brown (10YR 4/3), and yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; very friable; neutral; clear, wavy boundary.

B22tg—18 to 27 inches, gray (10YR 5/1) sandy loam; many, fine, faint and distinct, grayish-brown (10YR 5/2), dark-gray (10YR 4/1), and yellowish-brown (10YR 5/6) mottles; weak, medium and coarse, subangular blocky structure; friable; thin clay films on surfaces of peds and clay bridging between sand grains; 2 to 5 percent gravel; neutral; clear, wavy boundary.

B3g—27 to 36 inches, gray (5Y 5/1) loamy sand; common, fine, faint and distinct, yellowish-brown (10YR 5/6) and light olive-brown (2.5Y 5/4) mottles; very weak, medium and coarse, subangular blocky structure; very friable; 2 to 5 percent gravel; neutral; abrupt, wavy boundary.

IICg—36 to 62 inches, gray (5Y 5/1) coarse sand; single grain; loose; 1 to 2 percent fine gravel; calcareous.

The solum ranges from 24 to 40 inches in thickness but is dominantly about 36 inches thick. It ranges from medium acid to neutral throughout the upper part of the profile and from slightly acid to mildly alkaline throughout the lower part. Gravel content throughout the solum ranges from 0 to 7 percent.

In undisturbed places the A1 horizon is very dark brown (10YR 2/2) or black (10YR 2/1) sandy loam. It is about 4 inches thick. An A2g horizon is present in a few soil profiles and is dominantly olive-gray (5Y 5/2) or gray (10YR 5/1 or 5Y 5/1) sandy loam. The Ap horizon ranges from 7 to 10 inches in thickness. It is very dark gray (10YR 3/1) or very dark brown (10YR 2/2) and mainly sandy loam.

The B horizon is mainly gray (10YR 5/1 or 5Y 5/1), dark gray (10YR 4/1 or 5Y 4/1), grayish brown (10YR 5/2 or 2.5Y 5/2), or olive gray (5Y 5/2). Mottles are mostly yellowish brown (10YR 5/4, 5/6 or 5/8), light olive brown (2.5Y 5/4), grayish brown (10YR 5/2 or 2.5Y 5/2), dark brown (10YR 4/3), dark grayish grown (10YR 4/2), or dark gray (10YR 4/1 or 5Y 4/1). The B21g horizon is loamy sand or light sandy loam. The B22tg horizon is heavy loamy sand, sandy loam, or coarse loam to sandy clay loam. The B3g horizon is loamy sand, gravelly loamy sand, or light sandy loam. The B21g and B3g horizons are absent in a few profiles.

The C horizon is mainly grayish brown (10YR 5/2 or 2.5Y 5/2), dark gray (10YR 4/1 or 5Y 4/1), or gray (10YR 5/1 or 5Y 5/1). Where present, mottles are yellowish brown (10YR 5/6), brown (10YR 5/3), olive brown (2.5Y 4/4), light olive brown (2.5Y 5/4) and dark gray (N 4/0). The C horizon is sand, coarse sand, gravel, gravelly sand, and very gravelly sand.

The surface layer of these soils is a few inches thinner than that described in the defined range for the series, but this difference does not alter the usefulness and behavior of these soils.

Gilford soils occur near Deford and Bach soils. Gilford soils have a finer textured subsoil than Deford soils and contain more coarser materials. The subsoil and underlying materials of Gilford soils are coarser textured than those of Bach soils and are at a greater depth. The Gilford soils formed in materials similar to those of Corunna soils, but Gilford soils lack underlying loamy materials at a depth of 20 to 40 inches. The Gilford and Wasepi soils formed in similar materials, but the Gilford soils are in lower positions, are more poorly drained, and have a grayer subsoil than Wasepi soils.

Gilford sandy loam (0 to 2 percent slopes) (Gd).—This soil is on broad flats, in small, slightly concave depressions, and in narrow, nearly level drainageways. Areas of this soil range from 2 to 40 acres in size.

Included with this soil in mapping are narrow strips of somewhat poorly drained Metamora and poorly drained Corunna sandy loams. These included soils occur along the boundary of the mapping unit and are underlain by loamy materials at a depth of about 18 to 40 inches. Small areas of somewhat poorly drained Wasepi sandy loam are also included. Other inclusions are a few areas where the plow layer is mucky sandy loam and a few areas where the underlying material is loamy at a depth of 50 to 60 inches.

Most of this soil has been cleared and cultivated, but many areas are now idle or in pasture. Wetness and the low natural fertility are the main limitations of this soil. Gilford sandy loam can be overdrained and become droughty in midsummer. Where adequately drained, this soil is moderately suited to most locally adapted crops. Small woodlots and other forested areas of this soil are covered with wetland brush and second-growth hardwoods. Capability unit IIIw-6 (4c); woodland group 4w1.

Houghton Series

The Houghton series consists of nearly level, very poorly drained soils. These soils formed in well-decomposed, organic materials. The organic materials are more than 51 inches thick and were derived mainly from grasses, sedges, reeds, and aquatic plants that accumulated in the waters of old glacial lakes and in ponded areas. Houghton soils occur in depressional areas on lake plains, in glacial drainageways, and on undulating till plains.

In a typical profile the surface layer is black, highly decomposed organic material 10 inches thick. The next three layers consist of similar material and have a combined thickness of 20 inches. The organic material is primarily herbaceous but contains small amounts of woody fragments and mineral materials. The next layer consists of moderately decomposed organic material 8 inches thick. Below a depth of 38 inches, the organic layers are dark reddish brown and slightly less well decomposed organic material. They contain a few woody fragments and small amounts of mineral materials. The organic materials extend to a depth of more than 62 inches.

Surface runoff is ponded. Permeability is very rapid, and available water capacity is very high. These soils are of small extent in the county and of minor importance to farming. Wetness and the poor stability of these soils severely limit most nonfarm uses.

Typical profile of Houghton muck in idle area, SE¼NW¼SE¼SE¼ sec. 22, T. 8 N., R. 13 E., about 150 feet southeast of Winn Road and 150 feet north of drainage ditch:

Oa1—0 to 10 inches, black (5YR 2/1) sapric material; about 5 percent fiber but only a trace after rubbing; weak, fine, granular structure; very friable; mildly alkaline; clear, smooth boundary.

Oa2—10 to 13 inches, black (5YR 2/1) sapric material; about 12 percent fiber but less than 5 percent rubbed; massive separating to weak, thick, platy structure; friable; few discontinuous pockets of fine sand ½ to 1 inch thick; neutral; abrupt, smooth boundary.

Oa3—13 to 21 inches, dark reddish-brown (5YR 2/2) sapric material, black when (5YR 2/1) rubbed; about 15 percent fiber but less than 5 percent rubbed; massive separating to weak, medium and thick, platy structure; friable; woody fragments 1/16 to 1/4 inch in diameter; neutral; clear, smooth boundary.

Oa4—21 to 30 inches, black (5YR 2/1) sapric material; about 20 percent fiber but less than 10 percent rubbed; massive separating to weak, thin, platy structure; friable; few woody fragments 1/16 to 1/4 inch in diameter; slightly acid; clear, smooth boundary.

Oe1—30 to 38 inches, black (5YR 2/1) hemic material; about 40 percent fiber but 15 percent rubbed; massive separating to very weak, thin, platy structure; nonsticky, nonplastic; many woody fragments 1/16 to 1/2 inch in diameter; slightly acid; abrupt, smooth boundary.

Oa5—38 to 50 inches, dark reddish-brown (5YR 2/2) sapric material; about 30 percent fiber but less than 10 percent rubbed; massive; nonsticky, nonplastic; some woody fragments 1/16 to 1/2 inch in diameter; slightly acid; abrupt, smooth boundary.

Oa6—50 to 62 inches, dark reddish-brown (5YR 2/2) sapric material; about 25 percent fiber but less than 10 percent rubbed; massive; nonsticky, nonplastic; few woody fragments 1/16 to 1/2 inch in diameter; about 2 percent mineral materials; neutral.

The organic layers are more than 51 inches thick. Depth to underlying mineral materials normally ranges from 8 to 20 feet, but a few organic deposits are as much as 30 feet thick. The organic layers dominantly are sapric materials to a depth of 52 inches. Hemic materials are within the subsurface and bottom tiers, but these layers amount to less than 10 inches of the total thickness. The subsurface tier is between depths of 12 and 36 inches, and the bottom tier is between depths of 36 and 52 inches. The hemic materials contain an average of about 40 to 50 percent unrubbed fiber and between 10 and 25 percent after rubbing. In a few soil profiles, fibric layers also are in the lower layers of the subsurface tier, but they have a combined thickness of less than 5 inches. Many profiles have, in most layers, small amounts of woody pieces and fragments that range in size from 1/16 to 1 inch.

Mineral material throughout the profile consists mainly of fine sand, very fine sand, and silt. The content of this material is less than 1 to about 3 percent. The surface tier is between depths of 0 to 12 inches and is dominantly black (10YR 2/1 or 5YR 2/1) or very dark brown (10YR 2/2) sapric material. It ranges from medium acid to mildly alkaline. The subsurface tier consists dominantly of sapric organic layers that are black (10YR 2/1 or 5YR 2/1), very dark brown (10YR 2/2), or dark reddish brown (5YR 2/2). The unrubbed fiber content ranges from 2 to 30 percent and is 10 percent or less after rubbing. Reaction of the subsurface layers ranges from medium acid to neutral. The bottom tier consists mainly of sapric organic layers that are dark reddish brown (5YR 2/2), black (5YR 2/1), and very dark brown (10YR 2/2). The content of unrubbed fiber ranges from 20 to 33 percent and of rubbed fiber from 5 to 10 percent. The hemic layers are typically dark reddish brown (5YR 2/2), black (5YR 2/1), or very dark brown (10YR 2/2). The reaction of the bottom tier ranges from medium acid to neutral. Below a depth of 50 inches, the sapric layers amount to less than two-thirds of the total mass, and layers of hemic and fibric materials become more dominant with depth. Reaction ranges from medium acid to neutral. Colors are about the same as in the bottom tier but include very dark grayish brown (10YR 3/2) and dark brown (7.5YR 3/2).

Houghton soils are similar to Palms soils. Houghton soils formed in deeper deposits of organic materials than Palms soils and lack the underlying loamy mineral materials at a depth of from 16 to 50 inches. They occur near Bach, Thomas, Tobico, Corunna, Gilford, Hoytville, Toledo, Parkhill, and Deford soils. Houghton soils are very poorly drained and formed in deep deposits of organic materials, whereas the soils near them are poorly drained and very poorly drained, formed in mineral materials, and have a dark surface layer containing less than 20 percent organic matter.

Houghton muck (0 to 2 percent slopes) (Ha).—This deep, very poorly drained organic soil is level in large areas and also occupies small, slightly concave depressions. It occurs mostly in rounded, oval, or long, irregularly shaped areas that range from 2 to about 400 acres in size.

Included with this soil in mapping are areas of Palms muck in small, scattered spots and narrow strips around the soil boundary. The included Palms muck is underlain by silty clay loam at a depth of 16 to 50 inches. Also included are small areas of mineral soils that are mainly Parkhill loam, Bach very fine sandy loam, and Lamson fine sandy loam. These included mineral soils occur as small islandlike spots or areas along the boundaries of the mapping unit. Fire damage in some uncultivated areas of this soil has left holes, 1 foot to 4 feet deep, and an overall pitted surface. Most of these pits have a soft, powdery ash surface layer and short, choppy side slopes. Some 1- to 4-acre areas are included that are underlain by marl at a depth of 18 to 50 inches.

Wetness, hazards of frost and soil blowing, low natural fertility, and the instability of the organic materials are the main limitations to use of this soil. Drainage is needed for most crops. Tile drainage systems are difficult to install because of subsidence, lack of outlets, and unstable materials. Soil blowing is a concern in drained and cultivated areas. Most areas of this soil are farmed. Capability unit IIIw–15 (Mc); woodland group –w1.

Hoytville Series

The Hoytville series consists of nearly level, very poorly drained soils. These soils formed in limy clay glacial till materials. They occur on gently undulating ground moraines and water-laid moraines.

In a typical profile the surface layer is very dark gray silty clay loam 9 inches thick. The subsoil is 20 inches thick and divided into three layers. The upper layer is dark-gray, firm clay that has many small, contrasting spots and patches of yellowish brown and dark yellowish brown. The lower layers are gray, very firm clay spotted with dark gray, olive brown, and strong brown. The underlying material is limy, gray clay that has contrasting spots of olive brown.

Surface runoff is very slow or ponded. Permeability is slow, and available water capacity is moderate. Most areas of the Hoytville soils are cultivated, but farming is limited by wetness and poor workability. Wetness and slow permeability severely limit many nonfarm uses.

In St. Clair County the Hoytville soils were mapped in a complex with the Allendale soils and in a complex with the Nappanee soils.

Typical profile of Hoytville silty clay loam in an area of Nappanee-Hoytville complex, 0 to 3 percent slopes, in a cultivated field, NW1/4NE1/4 sec. 18, T. 5 N., R. 17 E., in a land claim area about 250 feet south of Davis Road:

Ap—0 to 9 inches, very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) when dry; weak, coarse and medium, granular structure; friable; 1 percent coarse fragments; medium acid; abrupt, wavy boundary.

B21g—9 to 17 inches, dark-gray (5Y 4/1) clay; common, medium and coarse, prominent, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) mottles; weak, medium, prismatic structure separating to weak, medium and coarse, angular blocky structure; firm; many, fine, black (10YR 2/1) worm casts; 1 percent coarse fragments; slightly acid; clear, wavy boundary.

B22tg—17 to 21 inches, gray (5Y 5/1) clay; many, medium, prominent, olive-brown (2.5Y 4/4) and strong-brown

(7.5YR 5/6) mottles and many, medium, faint, dark-gray (5Y 4/1) mottles; weak, medium, prismatic structure separating to weak, medium and coarse, angular blocky structure; very firm; continuous, thin clay films on most faces of peds and along cracks and root channels; 1 percent coarse fragments; slightly acid; gradual, wavy boundary.

B23tg—21 to 29 inches, gray (5Y 5/1) clay; many, medium, prominent, olive-brown (2.5Y 4/4) mottles and strong-brown (7.5YR 5/6) mottles and many, medium, faint, dark-gray (5Y 4/1) mottles; weak, medium, prismatic structure separating to weak, medium and coarse, angular blocky structure; very firm; few, thin, patchy clay films on faces of peds and along cracks and root channels; 1 percent coarse fragments; neutral; gradual, wavy boundary.

C1g—29 to 41 inches, gray (5Y 5/1) clay; many, medium, prominent, olive-brown (2.5Y 4/4) mottles and many, medium, faint, dark-gray (5Y 4/1) mottles; weak, medium, prismatic structure separating to weak, coarse, angular blocky structure; firm; calcareous; abrupt, wavy, boundary.

C2g—41 to 62 inches, gray (5Y 5/1) clay; many, medium, prominent, olive-brown (2.5Y 4/4) mottles; massive; firm; numerous light-gray (10YR 7/1 and 6/1) lime streaks; 1 percent coarse fragments; calcareous.

The solum is dominantly 29 to 42 inches thick but ranges from 22 to 50 inches in thickness. It ranges from medium acid to neutral throughout the upper part and from slightly acid to mildly alkaline throughout the lower part. Coarse fragments throughout the soil profile range from 1 to 5 percent gravel and are about 1 percent cobblestones. The Ap horizon is 5 to 10 inches thick and is mainly very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is heavy silt loam or silty clay loam.

Dominant color of the B21g horizon is dark gray (10YR 4/1 or 5Y 4/1), and the B22tg and B23tg horizons are mostly gray (10YR 5/1 or 5Y 5/1). The B horizon is clay or silty clay. The Bt horizons average between 45 and 55 percent clay. The prismatic structure in the B horizon ranges from weak to moderate, but in a few profiles, this strutcure is absent in either the upper or lower horizons. The angular blocky structure of the B horizon is weak to moderate and medium to coarse.

The underlying C horizon is mostly gray (10YR 5/1, 5Y 5/1) clay that has a clay content of 40 to 48 percent.

Although similar to the Latty and Paulding soils, the Hoytville soils have a lower percentage of clay in the profile. The Hoytville soils are similar to the Toledo soils in drainage and have about the same percentage of clay, but the Hoytville soils developed in glacial till and lack the lacustrine strata of Toledo soils. Hoytville soils formed in material similar to that of the Nappanee soils. They occupy lower, wetter positions than Nappanee soils and have a darker surface layer. Hoytville soils are similar to the Jeddo, Sims, and Parkhill soils, but have a higher clay content in the subsoil and underlying materials.

Jeddo Series

The Jeddo series consists of nearly level, very poorly drained soils. These soils formed in limy silty clay loam glacial till. They occur in depressional areas on till plains and ground moraines.

In a typical profile the surface layer is dark-gray silt loam 8 inches thick. It is very strongly acid. The subsoil is 38 inches thick. The upper part of the subsoil is 18 inches thick and consists of gray, firm silty clay loam and very firm silty clay that have small contrasting spots of dark yellowish brown, light olive brown, dark brown, strong brown, and yellowish red. The lower part of the subsoil is strong-brown and olive-brown, firm and very firm silty clay that has small contrasting spots of gray, dark gray, yellowish brown, and dark brown. The limy underlying material is olive-brown heavy silty clay loam that has contrasting dark-gray spots.

Surface runoff is very slow or ponded. Permeability is moderately slow, and available water capacity is high. Farming is limited by wetness, poor workability, and acidity. The wetness severely limits many nonfarm uses.

Typical profile of cultivated Jeddo silt loam, NW¼ SW¼ sec. 35, T. 8 N., R. 15 E., 150 feet east of road ditch and 270 feet north from east-west field ditch in a line opposite a single large oak tree:

Ap—0 to 8 inches, dark-gray (10YR 4/1) silt loam; very weak, medium, subangular blocky structure; friable; very strongly acid; abrupt, smooth boundary.

B21tg—8 to 17 inches, gray (5Y 5/1) heavy silty clay loam; few, fine, distinct, dark yellowish-brown (10YR 4/4) and light olive-brown (2.5Y 5/4) mottles; weak, medium, prismatic structure parting to weak, medium, angular blocky; firm; thin clay coatings on all surfaces of peds; very strongly acid; clear, wavy boundary.

B22tg—17 to 27 inches, gray (5Y 5/1) silty clay; many, fine, prominent, dark-brown (7.5YR 4/4), strong-brown (7.5YR 5/6), and yellowish-red (5YR 4/6) mottles; weak, medium, prismatic structure parting to weak, medium, angular blocky; very firm; thin clay coatings on most surfaces of peds and thick clay fillings and flows along root channels and cracks; very strongly acid; clear, wavy boundary.

B23t—27 to 35 inches, strong-brown (7.5YR 5/6) silty clay; many, fine and medium, prominent, gray (N 5/0) and dark-brown (10YR 4/3) mottles; very weak, medium, prismatic structure parting to very weak, coarse, angular blocky; very firm; thick clay coatings on vertical surfaces and clay fillings, ½ to 2 inches thick, in cracks and along old root channels; strongly acid; abrupt, wavy boundary.

B24t—35 to 46 inches, olive-brown (2.5Y 4/4) light silty clay; many, fine and medium, prominent, gray (N 5/0), dark-gray (N 4/0), and yellowish-brown (10YR 5/6) mottles; very weak, medium, prismatic structure parting to very weak, coarse, angular blocky structure; firm; thick clay fillings in cracks and root channels; neutral; abrupt, wavy boundary.

C—46 to 62 inches, olive-brown (2.5Y 4/4) heavy silty clay loam; many, fine and medium, prominent, dark-gray (N 4/0) mottles; massive; firm; many thick clay flows in cracks and root channels; calcareous.

The solum dominantly ranges from 40 to 49 inches in thickness and ranges from 35 to 55 inches. The Ap horizon ranges from 5 to 9 inches in thickness. It is mainly dark gray (10YR 4/1). In a few places, the Ap horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or very dark brown (10YR 2/2), but when dry, this horizon is light brownish gray (10YR 6/2) or light gray (10YR 6/1). The Ap horizon is loam or silt loam and ranges from very strongly acid to slightly acid.

Dominant colors of the B21g and B22tg horizons are gray (10YR 5/1 or 5Y 5/1). Mottles range from few to many and from faint to prominent. They are mainly dark yellowish brown (10YR 4/4), light olive brown (2.5Y 5/4), dark brown (10YR 4/3 and 7.5Y 4/4), yellowish red (5YR 4/6), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/4, 5/6 and 5/8). The B23t horizon is a mixture of colors. The matrix may be strong brown (7.5YR 5/6), dark brown (10YR 4/3), yellowish brown (10YR 5/6), or gray (10YR 5/1, 5Y 5/1, and N 5/0). Mottles of the other colors are in an almost equal mixture. The B24t horizon has about the same colors as the B23t horizon, but also included in this horizon are olive brown (2.5Y 4/4), light brownish gray (2.5Y 6/2 or 10YR 6/2), dark gray (10 YR 4/1 or 5Y 4/1 and N 4/0), yellowish red (5YR 4/6), and brown 10YR 5/3). The Bt horizons are heavy clay loam, silty clay loam, light clay, or silty clay. These horizons average between 35 and 45 percent clay. They range from very strongly acid to medium acid throughout the lower horizons.

The C horizon is mainly olive brown (2.5Y 4/4), dark brown (10YR 4/3), or brown (10YR 5/3). It has many, fine to medium, prominent mottles of dark gray (10YR 4/1, 5Y 4/1, or N 4/0), gray (10YR 4/1, 5Y 5/1, or N 5/0), and yellowish brown (10YR 5/6). The C horizon is clay loam or silty clay loam.

Jeddo soils are similar to Sims, Parkhill, Hoytville, Latty, and Paulding soils. Jeddo soils, however, have a thicker, more acid solum than the Sims soils and a finer textured, more acid subsoil and finer textured underlying material than the Parkhill soils. The Jeddo soils have a more acid subsoil and lower clay content in the subsoil and underlying materials than the Hoytville, Latty, and Paulding soils. Drainage of the Jeddo soils is similar to that of the Toledo soils, but Jeddo soils have a more acid subsoil. Also, Jeddo soils lack the contrasting stratification of clayey and loamy layers that occurs in the Toledo soils.

Jeddo silt loam (0 to 2 percent slopes) (Ja).—This soil occupies level to slightly concave depressions, narrow drainageways, and broad depressional flats. These areas range from 2 to 200 acres in size.

Included with this soil in mapping most areas are some small, scattered spots of Parkhill loam that contains less clay than this Jeddo soil. Also included are a few low, moundlike areas of somewhat poorly drained Blount loam. In some small areas, a soil is included that is similar to Jeddo silt loam but is slightly acid to neutral.

The main limitations to use of this soil are acidity, moderately slow permeability, and wetness. Drainage is difficult to establish because the subsoil is moderately slow in permeability. Most areas of this soil are cleared, and the few remaining wooded areas have stands of second-growth hardwoods. Capability unit IIw–2 (1.5c); woodland group 4w1.

Lake Beaches

Lake beaches (La) consists of sandy, gravelly, and in places cobbly narrow beaches that form the present shoreline of Lake Huron (fig. 8) and the St. Clair River. The beaches are constantly washed, shifted, and reworked by the erosive action of waves, ice, and wind. Because drastic changes normally occur after each local storm, the consistence and surface relief vary extremely in short periods.

Figure 8.—Area of Lake beaches used for recreation. This area is on Lake Huron.

These beaches are generally nearly level to gently sloping and have a single convex grade to the waterline. This land type is in areas that range from 2 to 40 acres in size. It supports little or no vegetation near the edge of the water, but some areas on the inland side have scattered clumps of aspen, willows, and beach grasses. The constant erosion hazard and the sandy soil material very severely limit areas of this unit for most uses other than recreation. Capability unit VIIIs–1 (Sa); woodland group not assigned.

Lamson Series

The Lamson series consists of nearly level, poorly drained soils that developed in water-laid layers of silt loam, loamy very fine sand, and very fine sandy loam. These soils occur in small depressions and broad, level areas of lake plains, glacial drainageways, and stream terraces.

In a typical profile the surface layer is black fine sandy loam 9 inches thick. The subsoil is 24 inches thick and consists of three layers. The upper layer is gray, very friable very fine sandy loam 9 inches thick. It has small spots of olive brown, light olive brown, light gray, and dark gray. The middle layer is light-gray, very friable very fine sandy loam 11 inches thick. It has olive-brown, grayish-brown, gray, and yellowish-brown spots. The lower layer is 4 inches thick and contains several, thin, alternating strata of very friable very fine sandy loam and friable silt loam. It is gray and has dark-gray, yellowish-brown, and light-gray spots. The limy underlying materials are layered, gray very fine sandy loam and olive-brown loamy very fine sand and silt loam.

Surface runoff is very slow to ponded. Permeability and available water capacity are moderate. These soils are important to farming, but good crop growth largely depends on adequate drainage. Wetness severely limits many nonfarm uses of these soils.

In this county the Lamson soils were mapped alone and also in complexes with Croswell soils and with Minoa soils.

Typical profile of Lamson fine sandy loam in a formerly cultivated field, NE¼SE¼NE¼ sec. 31, T. 3 N., R 16 E., about 100 feet south of Swartout Creek and 100 feet west of the road fence along Starville Road:

Ap—0 to 9 inches, black (10YR 2/1) fine sandy loam; weak, very fine, subangular blocky structure; very friable; neutral; abrupt, smooth boundary.

B21g—9 to 18 inches, gray (5Y 5/1) very fine sandy loam; many, fine, distinct, olive-brown (2.5Y 4/4) and light olive-brown (2.5Y 5/4) mottles and many, fine, faint, light-gray (5Y 6/1) and dark-gray (5Y 4/1) mottles; very weak, thick, platy structure; very friable; neutral; clear, wavy boundary.

B22g—18 to 29 inches, light-gray (5Y 6/1) very fine sandy loam; common, fine and medium, distinct, olive-brown (2.5Y 4/4) and grayish-brown (2.5Y 5/2) mottles, common, fine and medium, faint, gray (5Y 5/1) mottles and common, fine and medium, prominent, yellowish-brown (10YR 5/6) mottles; very weak, medium, subangular blocky structure; very friable; neutral; abrupt, wavy boundary.

B23g—29 to 33 inches, gray (5Y 5/1), stratified very fine sandy loam and silt loam in layers ¼ inch to 2 inches thick; common, fine, prominent, yellowish-brown (10YR 5/6) mottles and common, fine, faint, light-gray (5Y 6/1) and dark-gray (5Y 4/1) mottles; very weak, thin and medium, platy structure; friable and very friable; mildly alkaline; abrupt, wavy boundary.

C1g—33 to 49 inches, gray (5Y 5/1) very fine sandy loam; common, fine and medium, distinct, olive-brown (2.5Y 4/4), light olive-brown (2.5Y 5/4), and grayish-brown (2.5Y 5/2) mottles; massive, very friable; calcareous; abrupt, wavy boundary.

C2—49 to 55 inches, olive-brown (2.5 4/4) loamy very fine sand; many, fine, distinct, light olive-brown (2.5Y 5/4), gray (10YR 5/1), and yellowish-brown (10YR 5/6) mottles; massive; very friable; calcareous; abrupt, wavy boundary.

C3—55 to 62 inches, olive-brown (2.5Y 4/4) silt loam; common, medium and coarse, distinct, grayish-brown (2.5Y 5/2) and yellowish-brown (10YR 5/6) mottles; massive; very friable; calcareous.

The solum is dominantly 26 to 40 inches thick but ranges from 22 to 50 inches in thickness. Between depths of 10 and 40 inches, these soils are less than 18 percent clay and 40 to 80 percent very fine sand and silt. It is slightly acid or neutral throughout the upper part and slightly acid to mildly alkaline throughout the lower part.

In forested areas these soils have an A1 horizon that is 4 to 6 inches thick and black (10YR 2/1) or very dark gray (10YR 3/1 or 5Y 3/1). The Ap horizon is black (10YR 2/1), very dark gray (10YR 3/1 or 5Y 3/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). It ranges from 7 to 10 inches in thickness and has a dominant texture of fine sandy loam, very fine sandy loam, or silt loam.

The Bg horizon is mainly dark gray (10YR 4/1 or 5Y 4/1), gray (10YR 5/1 or 5Y 5/1), grayish brown (10YR 5/2 or 2.5Y 5/2), and light gray (10YR 6/1 or 5Y 6/1). Mottles are mainly yellowish brown (10YR 5/6 and 5/8), gray (10YR 5/1 and 5Y 5/1), dark gray (10YR 4/1 and 5Y 4/1), light gray (10YR 6/1 and 5Y 6/1), light brownish gray (10YR 6/2 and 2.5Y 6/2), grayish brown (10YR 5/2 and 2.5Y 5/2), olive brown (2.5Y 4/4), dark brown (10YR 4/3), and light olive brown (2.5Y 5/4). The texture, thickness, and sequence of the layers in the B horizon vary in short horizontal distances. These layers are mainly very fine sandy loam, fine sandy loam, loamy very fine sand, silt loam, very fine sand, sandy loam, and loam.

The C horizon has colors approximately the same as those of the Bg horizon, but in the lower part of the C horizon, the dominant colors include olive brown (2.5Y 4/4) and dark grayish brown (10YR 4/2 or 2.5Y 4/2). Mottles are about the same as those of the Bg horizon. Texture and sequence of the layers in the C horizon vary, and the texture is about the same as that of the Bg horizon. In a few profiles the lower part of the C horizon has thin layers of fine sand, sand, light silty clay loam, and clay loam.

Between the surface layer (A1 or Ap horizon) and a depth of 30 inches, these soils are grayer than the defined range for the series, but this difference does not alter the usefulness and behavior of these soils.

Lamson soils are similar to Bach, Gilford, and Deford soils. The Lamson soils have calcareous soil material at a depth of more than 22 inches, and Bach soils do not. Lamson soils formed in materials containing a smaller amount of coarse fragments than the materials of Gilford soils and a larger amount of silt, fine sand, and very fine sand. The subsoil and substratum of Lamson soils are dominantly loamy, but corresponding layers in the Deford soils are sandy. Although developed in materials similar to those of Minoa soils, Lamson soils are wetter and have a darker surface layer and a grayer subsoil. Lamson soils occur near Lenawee, Toledo, and Thomas soils but formed in material that is coarser textured than the material in which those soils formed. Also, Lamson soils have a less alkaline subsoil than the Thomas soils.

Lamson fine sandy loam (0 to 2 percent slopes) (Ld).—This poorly drained soil occupies level to slightly concave depressions, narrow drainageways, and broad level areas. These areas range from 2 to about 500 acres in size.

Included with this soil in mapping are many spots that are less than 1 acre in size and consist of limy Bach very fine sandy loam, somewhat poorly drained Minoa fine sandy loam, and Lenawee silt loam that consists mainly of silty clay loam. Also included are small areas that have an organic surface layer 10 to 15 inches thick. Included around the outer edges of this mapping unit are small spots and narrow strips that are underlain by loamy till or lacustrine clay materials at a depth of 30 to 40 inches.

Wetness and the layers of silt loam and fine sandy materials are the main limitations of this soil. Drainage is difficult because the silt and fine sandy layers tend to flow when wet, and ditchbanks slough and tile drains are plugged. Many of the smaller areas of this soil are subject to ponding by surface runoff from the surrounding uplands.

Where adequate drainage is established and maintained, this soil is well suited to most locally adapted crops. Most areas of this soil are farmed. Scattered wooded areas have stands of second-growth hardwoods. Capability unit IIw-6 (3c); woodland group 4w1.

Latty Series

The Latty series consists of nearly level, very poorly drained soils that formed in limy, lacustrine clay. These soils occur in broad, flat areas, small depressions, and narrow drainageways on lake plains.

In a typical profile the surface layer is dark grayish-brown silty clay loam 8 inches thick. The subsoil is gray, firm and very firm clay that is 31 inches thick and is mottled with many, small spots of strong brown. The underlying material is limy, gray clay that has many, small, scattered spots of strong brown.

The surface runoff is very slow to ponded. Permeability is very slow, and available water capacity is moderate. Most areas of these soils are cultivated, but farming is limited by wetness and poor workability. Wetness and very slow permeability severely limit these soils for many nonfarm uses.

In St. Clair County the Latty soils were mapped alone and also in a complex with the Allendale soils.

Typical profile of Latty silty clay loam in a clover field, SE¼SE¼ sec. 11, T. 3 N., R. 15 E., 50 feet east and 75 feet north of fence corner that is west of the second telephone pole that is west of the corner of Palms and Shortcut Roads:

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

B21g—8 to 12 inches, gray (5Y 5/1) clay; common, medium, prominent, strong-brown (7.5YR 5/8) mottles; moderate, medium, angular blocky structure; firm; slightly acid; clear, wavy boundary.

B22g—12 to 24 inches, gray (5Y 5/1) clay; many, coarse, prominent, strong-brown (7.5YR 5/8) mottles; moderate, medium, prismatic structure separating to weak, medium, angular blocky; very firm; slightly acid; gradual, wavy boundary.

B23g—24 to 39 inches, gray (5Y 5/1) clay; many, medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, coarse, angular blocky structure; very firm; neutral; gradual, wavy boundary.

C1g—39 to 62 inches, gray (5Y 5/1) clay; many, medium, prominent, strong-brown (7.5YR 5/8) mottles; very weak, coarse, angular blocky structure grading to massive with depth; firm; calcareous.

The solum is dominantly 28 to 45 inches thick but ranges from 24 to 50 inches in thickness. It ranges from slightly acid to mildly alkaline throughout. Clay content of the B and C horizons ranges from 50 to 60 percent. Cracks during dry periods have openings 1 to 3 inches wide on the surface, and the cracks extend to a measurable depth of 27 inches.

The Ap horizon is normally 8 or 9 inches thick but ranges from 6 to 10 inches in thickness. It is mainly dark grayish brown (10YR 4/2) or very dark gray (10YR 3/1) when moist and is light gray (2.5Y 7/2) when dry.

The B horizon is gray (5Y 5/1 or 10YR 5/1) or dark gray (5Y 4/1 or 10YR 4/1). It has prismatic structure that ranges from weak to moderate. In a few soil profiles, the prismatic structure is in all layers of the B horizon.

Latty soils are similar to Paulding, Hoytville, and Jeddo soils. Latty soils have a lower clay content in the subsoil than the Paulding soils and a higher clay content in the subsoil and finer textured underlying materials than the Hoytville and Jeddo soils. Latty soils occur near areas of Toledo and Lenawee soils. Latty soils have more clay in the subsoil and underlying material than the Toledo and Lenawee soils. Also, they lack the stratification and coarser textured layers of the Toledo and Lenawee soils.

Latty silty clay loam (0 to 2 percent slopes) (Le).—This very poorly drained soil is in slightly concave depressions, narrow drainageways, and broad, level areas. These areas range from 3 to 300 acres in size and from long and narrow to wide and irregular in shape. The profile of this soil is that described as typical for the series.

Included with this soil in mapping are a few areas of Latty soil that has a clay loam plow layer. Also included are small, domelike sandy mounds of Allendale loamy fine sand. Other inclusions are areas of soils that are similar to Latty silty clay loam but are somewhat poorly drained and occur on low, convex rises or mounds. Small areas of Lenawee soil that has a silt loam surface layer are included in some areas and occur mostly in narrow drainageways. This included soil has considerably less clay in its profile than Latty silty clay loam.

Most areas of Latty silty clay loam have been cleared and either cropped or pastured. The main limitations of this soil are wetness, the high clay content, and the very slow permeability. This soil is moderately suited as cropland. It is very difficult to drain. When wet, it is slippery and very plastic, and when dry, it becomes very hard and cracks open. Optimum workability is only for short periods. Woodlots on these soils have second-growth stands of hardwoods. Capability unit IIIw–1 (1c); woodland group 4w1.

Latty complex, 0 to 3 percent slopes (LhA).—This complex consists of very poorly drained Latty silty clay loam and a somewhat poorly drained, clayey soil similar to Latty soils except for the difference in drainage. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. They are level to very gently undulating and occur in broad areas. These areas normally range from 60 to 300 acres in size.

Very poorly drained Latty silty clay loam makes up about 40 to 50 percent of this complex and occupies the lower, slightly concave depressions, drainageways, and nearly level areas. The somewhat poorly drained soil that has texture similar to that of Latty silty clay loam makes up the other 40 to 50 percent of the area. This clayey, somewhat poorly drained soil occupies the higher, slightly convex, domelike mounds, knolls, and rises. The profile of the somewhat poorly drained soil has a thinner subsoil than the profile described for the Latty series, and depth to the limy, underlying clay ranges from about 18 to 28 inches. Also, the plow layer is slightly lighter colored than the Latty soil and is heavy loam.

Included in this complex in mapping are many, small, scattered spots and other areas of stratified, loamy and clayey, somewhat poorly drained soils. These included stratified soils occur in areas less than 3 acres in size, but they amount to as much as 10 percent of some areas. Also included are small, scattered, moundlike spots of Allendale soils that have loamy fine sand and fine sand extending to a depth of less than 18 inches. These spots are about 50 to 125 feet in diameter. Other inclusions are areas of somewhat poorly drained Minoa fine sandy loam.

Wetness, the high clay content, and very slow permeability of these soils are the main limitations. Uniform drainage is difficult to obtain, and effective tile drainage is difficult to establish. Ponded surface water and poor soil tilth are concerns in farming these soils. These soils are moderately suited as cropland, and most areas are farmed. Capability unit IIIw–1 (1c); woodland group 4w1.

Latty Series, Sandy Subsoil Variant

The Latty series, sandy subsoil variant, consists of nearly level, very poorly drained soils that formed in 20 to 40 inches of lacustrine clay underlain by a thin layer of clay loam over fine sand. These soils occur in level to slightly depressed areas on the lake plains.

In a typical profile the surface layer is very dark gray silty clay loam 8 inches thick. The subsoil is gray, very firm clay that has small scattered mottles of yellowish brown and light gray. It is 21 inches thick. The limy underlying materials consist of three layers. The upper layer is 7 inches thick and is gray clay mottled with yellowish brown and brown. The middle layer is 2 inches thick and consists of gray clay loam mottled with light olive brown, yellowish brown, and grayish brown. The lower layer starts at 38 inches below the surface and extends to a depth of more than 64 inches. This layer is gray fine sand.

Surface runoff is slow to very slow. Permeability is very slow in the clayey upper part of these soils and rapid in the sandy lower part. Available water capacity is moderate in the clayey upper part and low in the sandy lower part. These soils are locally important for farming, though farming is limited by wetness and poor workability. Wetness and the clayey upper part of these soils severely limit most nonfarm uses.

Typical profile of Latty silty clay loam, sandy subsoil variant, in an area of Latty complex, sandy subsoil variant, 0 to 3 percent slopes, in a cultivated field, SW¼NW¼SW¼ sec. 18, T. 6 N., R. 16 E., about 90 feet east of road ditch and 120 feet north of culvert under Mayer Road:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam; very weak, fine, subangular blocky structure; friable; medium acid; abrupt, smooth boundary.

B21g—8 to 22 inches, gray (5Y 5/1) clay; common, fine, distinct, yellowish-brown (10YR 5/6 and 5/8) mottles; very weak, medium, prismatic structure separating to moderate, fine and medium, angular blocky; very firm; neutral; clear, wavy boundary.

B22g—22 to 29 inches, gray (5Y 5/1) clay; many, medium, distinct, yellowish-brown (10YR 5/6 and 5/8) and common, fine, faint, light-gray (5Y 6/1) mottles; weak, medium, prismatic structure separating to moderate, fine and medium, angular blocky; very firm; neutral; abrupt, wavy boundary.

C1g—29 to 36 inches, gray (5Y 5/1) clay; many, fine, distinct and prominent, brown (10YR 5/3) and yellowish-brown (10YR 5/6, 5/8) mottles; very weak, medium, prismatic structure separating to weak, medium, angular blocky; very firm; calcareous; abrupt, wavy boundary.

IIC2g—36 to 38 inches, gray (5Y 5/1) clay loam; common, fine, distinct, light olive-brown (2.5Y 5/4), yellowish-brown (10YR 5/6), and grayish-brown (10YR 5/2) mottles; massive; firm; calcareous; abrupt, wavy boundary.
IIIC3g—38 to 64 inches, gray (5Y 5/1) fine sand; many, coarse, faint, grayish-brown (2.5Y 5/2) mottles; single grain; loose; calcareous.

Depth to the sandy underlying materials is commonly 30 to 40 inches but ranges from 20 to 40 inches. The solum ranges from 10 to 37 inches in thickness. It is slightly acid to neutral throughout the upper part and is neutral to mildly alkaline throughout the lower part. The Ap horizon ranges from 6 to 9 inches in thickness and is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is heavy loam, clay loam, or silty clay loam.

The B horizon is dominantly gray (10YR 5/1 or 5Y 5/1) and is mottled mainly with yellowish brown (10YR 5/4, 5/6 and 5/8), light gray (10YR 6/1 or 5Y 6/1), and grayish brown (10YR 5/2). It is clay that has an average clay content between 50 and 60 percent. The prismatic structure is absent in a few soil profiles.

The C1g horizon ranges from 3 to 25 inches in thickness and is dominantly gray (10YR 5/1 or 5Y 5/1) or light gray (10YR 6/1 or 5Y 6/1). It is clay and is mildly alkaline or moderately alkaline (calcareous). The IIC2g horizon is absent in a few profiles, but if present, it ranges from 1 to 15 inches in thickness, from sandy loam to clay loam in texture, and from mildly alkaline to moderately alkaline (calcareous) in reaction. The IIIC3g horizon, or sandy underlying material, is gray (10YR 5/1 or 5Y 5/1), light gray (10YR 6/1 or 5Y 6/1) or grayish brown (10YR 5/2 or 2.5Y 5/2) with or without mottles. It is sand, fine sand, or very fine sand. In some profiles the sand, fine sand, and very fine sand are stratified, and others have thin, discontinuous layers of loamy sand or loamy fine sand. Reaction is mildly alkaline to moderately alkaline (calcareous).

Latty soils, sandy subsoil variant, occur near areas of Latty, Paulding, Lenawee, Lamson, Toledo, and Thomas soils. Latty soils, sandy subsoil variant, are underlain by sand or fine sand at a depth of 20 to 40 inches, and the normal Latty soils and the Paulding soils are not. They have slightly less clay content in the subsoil and clayey underlying materials than the Paulding soils. Latty soils, sandy subsoil variant, have a finer textured subsoil than Lenawee and Lamson soils and are underlain by coarser textured materials at a depth of 20 to 40 inches. They have a slightly higher clay content in the clayey subsoil and dominantly coarse textured underlying materials than the Toledo and Thomas soils, and they show less stratification with materials of contrasting texture.

Latty complex, sandy subsoil variant, 0 to 3 percent slopes (LlA).—This complex consists of very poorly drained Latty soils that have a sandy subsoil, and a somewhat poorly drained, clayey soil that is similar to the Latty soils, except for the difference in drainage. These soils occur next to each other in areas too small to be mapped separately. They are level to very gently undulating. These areas range from 40 to about 2,000 acres in size. The very poorly drained Latty soils, sandy subsoil variant, make up about 50 percent of the complex and occur in the lower, slightly concave depressions, drainageways, and flat areas. The somewhat poorly drained clayey soil underlain by sand makes up about 35 to 45 percent of the complex and occupies the higher, slightly convex mounds, knolls, and low ridges. Slopes are short and dominantly 2 to 3 percent. A profile of a Latty soil in this complex is described as typical for the Latty series, sandy subsoil variant. The somewhat poorly drained clayey soil also has a profile similar to that described for the Latty series, sandy subsoil variant, except that the profile is not so wet, is less gray in the subsoil, and has a slightly lighter colored heavy loam plow layer.

Included in this complex in mapping are many scattered areas that are 1 to 3 acres in size and consist of Latty silty clay loam that lacks the lower sandy layer in the subsoil. Also included are many small, scattered mounds of fine sand that are less than 18 inches thick and are 50 to 125 feet in diameter, and mounds of Allendale loamy fine sand. Included in the somewhat poorly drained areas are small spots of a soil that has a sandy loam surface layer.

Wetness, the high clay content, and the very slow permeability in the clayey part of these soils are the main limitations. Uniform drainage is difficult to obtain, but wetness can be considerably reduced by draining the underlying sandy material. Ponded surface water and poor tilth are management concerns in farming these soils. These soils are moderately suited as cropland. Most areas of these soils are farmed. Capability unit IIIw–1 (1c); woodland group 4w1.

Lenawee Series

The Lenawee series consists of nearly level, poorly drained soils. These soils formed in water-laid limy sediments of very fine sandy loam, silt loam, and silty clay loam. They occur in small depressions and broad, level areas on lake plains and glacial drainageways.

In a typical profile the surface layer is very dark brown silt loam 10 inches thick. The subsoil is 32 inches thick and consists of four layers. The upper two layers combined are 13 inches thick and are dark-gray, friable, and firm silty clay loam mottled with dark yellowish brown, strong brown, and yellowish brown. The middle or third layer is mottled strong-brown and dark-gray, firm heavy silty clay loam that is 8 inches thick and has small olive-brown and gray mottles. The lower layer is gray, firm light silty clay that is 11 inches thick and is mottled with strong brown, gray, and dark yellowish brown. The layered underlying materials are dominantly limy, gray silty clay loam that has thin layers of very fine sandy loam and silt loam.

Surface runoff is very slow to ponded. Permeability is moderately slow, and available water capacity is high. These soils are important locally to farming. Wetness severely limits many nonfarm uses.

In this county the Lenawee soils were mapped alone and also in a complex with Allendale and Toledo soils.

Typical profile of Lenawee silt loam in a cultivated field, SW¼SE¼SE¼SW¼ sec. 23, T. 4 N., R. 16 E., 60 feet north of road ditch and 170 feet west of north-south field ditch:

Ap—0 to 10 inches, very dark brown (10YR 2/2) silt loam; weak, fine, subangular blocky structure; friable; neutral; abrupt, smooth boundary.
B21g—10 to 16 inches, dark-gray (5Y 4/1) light silty clay loam; common, fine, distinct and prominent, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; moderate, medium and fine, subangular blocky structure; friable; neutral; clear, wavy boundary.
B22g—16 to 23 inches, dark-gray (5Y 4/1) silty clay loam; common, fine, distinct and prominent, dark yellowish-brown (10YR 4/4) and strong-brown (7.5YR 5/6) mottles; weak, medium, prismatic structure separating to moderate, fine and medium, angular blocky; firm; neutral; clear, wavy boundary.
B23g—23 to 31 inches, mottled dark-gray (5Y 4/1) and strong-brown (7.5YR 5/6) heavy silty clay loam; few, fine, prominent, olive-brown (2.5Y 4/4) mottles and many, fine, prominent, gray (N 5/0) mottles; very weak, medium, prismatic structure separating to moderate, fine and medium, angular blocky; firm; mildly alkaline; clear, wavy boundary.

B3g—31 to 42 inches, gray (5Y 5/1) light silty clay; many, medium, prominent, strong-brown (7.5YR 5/6), dark yellowish-brown (10YR 4/4), and gray (N 5/0) mottles; weak, medium, angular blocky structure; firm; calcareous; clear, wavy boundary.

C1g—42 to 54 inches, gray (5Y 5/1) silty clay loam; many, medium, prominent, strong-brown (7.5YR 5/6), dark yellowish-brown (10YR 4/4), and gray (N 5/0) mottles; massive; firm; many, thick clay flows along cracks and root channels; calcareous; abrupt, wavy boundary.

IIC2g—54 to 62 inches, gray (N 5/0), thin layers of very fine sandy loam, silt loam, and silty clay loam 1/16 to 3/4 inch thick; many, medium, prominent, yellowish-brown (10YR 5/6) and olive-brown (2.5Y 4/4) mottles; massive; friable to firm; calcareous.

The solum is commonly 30 to 42 inches thick but ranges from 22 to 42 inches in thickness. It is slightly acid to neutral throughout the upper part and neutral to mildly alkaline throughout the lower part. The Ap horizon ranges from 8 to 10 inches in thickness and is very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), or very dark gray (10YR 3/1). It is loam or silt loam.

The main colors of the B21g and B22g horizons are gray (10YR 5/1 or 5Y 5/1), dark gray (10YR 4/1 or 5Y 4/1), light gray (10YR 6/1 or 5Y 6/1), and yellowish brown (10YR 5/6). Mottles are mainly yellowish brown (10YR 5/6 and 5/8), strong brown (7.5YR 5/6 and 5/8), and dark yellowish brown (10YR 4/4). The dominant colors of the lower part of the B horizon are about the same as those of the B21g and B22g horizons but include a matrix color of strong brown (7.5YR 5/6) and many, prominent, gray (10YR 5/1 or 5Y 5/1 and N 5/0) mottles. These horizons also have threadlike networks of gray mottles surrounding the patches of strong brown.

The B horizon is dominantly silty clay loam, clay loam, light clay, or silty clay. A few soil profiles have thin layers of very fine sandy loam, loam, and silt loam. Between depths of 10 and 40 inches, the clay content averages between 35 and 45 percent.

The C horizon is mainly gray (10YR 5/1, N 5/0, or 5Y 5/1), dark gray (10YR 4/1 or 5Y 4/1), or grayish brown (10YR 5/2). It is dominantly silty clay loam, clay loam, and light clay, but the layers in the C horizon have a wider range of texture and vary more than the B horizon. Reaction is mildly alkaline to moderately alkaline (calcareous).

Lenawee soils occur near areas of Lamson, Thomas, Toledo, Latty, and Paulding soils. Lenawee soils have a finer textured subsoil and underlying materials than Lamson soils. Lenawee soils are less alkaline in the subsoil than the Thomas soils and are deeper to limy materials. Lenawee soils developed in coarser textured materials than Toledo soils and have a lower average clay content. Lenawee soils developed in coarser textured and more contrastingly stratified materials than Latty or Paulding soils. Lenawee soils are similar to Bach soils but have a finer textured, more acid, thicker subsoil.

Lenawee silt loam (0 to 2 percent slopes) (Lm).—This poorly drained soil occupies level to slightly concave depressions, nearly level drainageways, and broad flats. The areas range from 2 to about 200 acres in size and are generally longer than they are wide. This soil has the profile described as typical for the series.

Included with this soil in mapping are small scattered areas of limy Thomas mucky silt loam. Also included are convex mounds and rises of somewhat poorly drained soils that are similar to Lenawee silt loam. Other inclusions are narrow strips around the outer edges of this mapping unit, and within the unit, islandlike spots that are underlain by deep heavy clay at a depth of 30 to 48 inches.

Wetness is the main limitation of this soil. Where adequately drained, this soil is well suited to most locally adapted crops. Some of the smaller areas and drainageways are subject to ponding by surface water from the surrounding uplands. Most areas are farmed. The remaining woodlots have stands of second-growth hardwoods, and many have been heavily pastured. Capability unit IIw–2 (1.5c); woodland group 3w3.

Lenawee complex, 0 to 3 percent slopes (LnA).—This complex consists of poorly drained Lenawee silt loam and a somewhat poorly drained, stratified loamy soil. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. They are level to very gently undulating. Areas of this complex range from 40 to 50 acres in size. The Lenawee soil makes up from 55 to 65 percent of the complex and occupies the lower, slightly concave depressions, narrow drainageways, and depressed flats. The somewhat poorly drained soil makes up 30 to 40 percent of the complex and occupies the higher, slightly convex mounds, knolls, and low rises. The profile of the Lenawee silt loam is similar to that described as typical for the series. The somewhat poorly drained soil formed in stratified, loamy materials similar to those in which Lenawee silt loam formed.

Included in this complex in mapping are small spots and other areas of Minoa and Lamson fine sandy loams and Toledo silty clay loam. The included Minoa and Lamson fine sandy loams have considerably more very fine sandy loam in their profiles than Lenawee silt loam, and Toledo silty clay loam has considerably more clay.

Wetness is the major limitation of the soils in this complex. Uniform drainage is difficult to obtain, but where adequate drainage is established, these soils are well suited to most locally adapted crops. Most areas of these soils are farmed. Capability unit IIw–2 (1.5c); woodland group 3w3.

Londo Series

The Londo series consists of level to gently sloping, somewhat poorly drained soils. These soils formed in limy loam glacial till. They occur on gently undulating water-laid moraines and till plains.

In a typical profile the surface layer is very dark grayish-brown loam 8 inches thick. The subsoil is 10 inches thick. In the upper part it consists of a mixture of a dark-brown, firm light clay loam subsoil layer and what is left of a brown, friable loam subsurface layer. The loam occurs as fillings in the wider vertical cracks and as coatings on the prismatic surfaces of the light clay loam materials. The lower 7 inches of the subsoil is dark grayish-brown, firm clay loam that has many, small, faint spots of grayish brown and dark brown. The upper part of the subsoil is neutral, and the lower part is mildly alkaline. The underlying material is limy, yellowish-brown loam.

Surface runoff is slow to medium and depends on the percentage of slope. Permeability is moderate. Available water capacity is high. Artificial drainage is needed for good crop growth, but Londo soils are among the best soils in the county for farming. The wetness of these soils limits many nonfarm uses.

Typical profile of Londo loam, 0 to 2 percent slopes, in a cultivated field, NE1/4NE1/4NE1/4 sec. 2, T. 7 N., R. 16 E., 160 feet west of north-south field boundary fence and 100 feet south of road ditch:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; weak, medium, granular structure; very friable; 5 percent coarse fragments; abrupt, smooth boundary.

B&A—8 to 11 inches, A part, brown (10YR 5/3) loam; common, fine, faint, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4) mottles; weak, medium, platy structure; very friable; expressed as a 1-inch discontinuous layer that has vertical tongues ⅛ to 1 inch in diameter and 1 to 3 inches long, extending into the B part and as thick coatings on all prismatic faces of peds, root channels, and vertical cracks of the B part; B part, dark-brown (7.5YR 4/4) light clay loam; many, fine, distinct, grayish-brown (10YR 5/2), dark grayish-brown (10YR 4/2), and yellowish-brown (10YR 5/6) mottles; very weak, medium, prismatic structure separating to moderate, medium and fine, subangular blocky structure; friable and firm; interior blocky faces of peds have only scattered, small patches of thin A horizon coatings; 5 percent coarse fragments; neutral; clear, wavy boundary.

B2t—11 to 18 inches, brown (10YR 4/3) clay loam; common, fine, distinct, grayish-brown (10YR 5/2) mottles; very weak, medium, prismatic structure separating to moderate, medium, angular blocky structure; firm; dark grayish-brown (10YR 4/2), thin clay films on all faces of peds; common, fine, faint, grayish-brown (10YR 5/2) mottles and common, fine, distinct, dark-brown (7.5YR 4/4) mottles on faces of peds; 5 percent coarse fragments; mildly alkaline; abrupt, wavy boundary.

C1—18 to 29 inches, yellowish-brown (10YR 5/4) loam; common, fine, faint, dark yellowish-brown (10YR 4/4) and grayish-brown (10YR 5/2) mottles and common, fine, distinct, light brownish-gray (10YR 6/2) and reddish-brown (5YR 5/4) mottles; weak, thick, platy structure; friable; 5 percent coarse fragments; calcareous; gradual, wavy boundary.

C2—29 to 62 inches, yellowish-brown (10YR 5/4) loam; common, fine, distinct, yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2) mottles and common, fine, prominent, gray (N 6/0) mottles; massive; friable; many thin streaks, small spots, and fine concretions of light-gray (10YR 7/2) secondary lime; 5 percent coarse fragments; calcareous.

The solum ranges from 12 to 25 inches in thickness but dominantly is 16 to 23 inches thick. Coarse fragments throughout the soil profile range from 5 to 10 percent gravel and 1 to 2 percent cobblestones. The Ap horizon is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or dark grayish brown (10YR 4/2), and all these colors have a dry value of 6. The Ap horizon is fine sandy loam, loam, or silt loam. It ranges from slightly acid to mildly alkaline.

A few profiles have an A&B horizon instead of a B&A horizon. In forested areas thin A1 and A2 horizons are present. The A2 horizon and the A parts of the A&B or B&A horizon are fine sandy loam, loam, or silt loam and are brown (10YR 5/3) or yellowish brown (10YR 5/4). The B part of both the A&B and B&A horizons is dominantly dark brown (7.5YR 4/4 or 10YR 4/3), dark yellowish brown (10YR 4/4), or dark grayish brown (10YR 4/2). Mottles are faint or distinct and mainly dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and yellowish brown (10YR 5/4 and 5/6). A few soil profiles lack the prismatic structure in the B&A horizon. The B part in the B&A and A&B horizons is light clay loam. Reaction of the A&B or the B&A horizon ranges from slightly acid to mildly alkaline.

The clay films on the surfaces of the blocks in the angular blocky structure in the B2t horizon have a dominant color of dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2), and the centers of the blocks are dark brown (10YR 4/3) or dark yellowish brown (10YR 4/4). Mottles of both the surfaces and centers are mainly grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), dark brown (7.5YR 4/4), and yellowish brown (10YR 5/6). A few soil profiles lack the prismatic structure. The blocky structure in a few profiles is weak or moderate and medium or coarse. The B2t horizon is clay loam or light clay loam. A few profiles have a B3 horizon that is light clay loam and has subangular blocky structure, mildly alkaline reaction, and the same colors as the B2t horizon.

Dominant color of the C horizon is yellowish brown (10YR 5/4) or brown (10YR 5/3). The mottles dominantly are yellowish brown (10YR 5/4, 5/6, 5/8), light brownish gray (10YR 6/2), gray (10YR 5/1, N 6/0), grayish brown (10YR 5/2 and 2.5Y 5/2), reddish brown (5YR 5/4), and dark yellowish brown (10YR 4/4). The C horizon is loam, heavy loam, or light clay loam.

The Londo soils have drainage similar to that of the Blount, Conover, Sanilac, and Pert soils. The Londo soils have a thinner, coarser textured, more alkaline subsoil than the Blount soils. Londo soils are shallower to free carbonates than the Conover soils and have a thinner, more alkaline subsoil. Londo soils developed in loam or silt loam till materials and have a finer textured subsoil and underlying materials than the Sanilac soils, which were derived from lacustrine materials. The subsoil and underlying materials of Londo soils are coarser textured than corresponding layers of the Pert soils.

Londo loam, 0 to 2 percent slopes (LoA).—This somewhat poorly drained soil occurs as parts of a broad, generally single-graded plain that drains eastward into Lake Huron. Areas of this soil range from 5 to 300 acres in size and slopes are dominantly 1 percent. The shape of the areas ranges from wide and irregular to long and narrow. The main drainageways form a pattern of almost straight lines that are perpendicular to the Lake Huron shoreline. In some places these drainageways have cut considerably below the surface of these soil areas. A profile of this soil is described as typical for the series. In many scattered spots this soil is calcareous at the surface.

Included with this soil in mapping are some small, scattered, sandy, caplike mounds of Avoca loamy sand. Also included is poorly drained Parkhill loam in many of the small, scattered depressions and narrow drainageways. Other inclusions are a few, short, gently sloping areas bordering major drainageways and spots of a Londo soil that has a sandy loam surface layer.

The main limitation of this soil is wetness. Wetness is somewhat alleviated by a well-defined pattern of surface drainage, but additional internal drainage is needed. Where adequately drained, this soil is well suited to most locally adapted crops. The natural lime content is high. This is one of the most prouctive soils in the county, and most of it is farmed. Capability unit IIw–4 (2.5b); woodland group 3w1.

Londo loam, 2 to 6 percent slopes (LoB).—This somewhat poorly drained soil occurs as parts of a broad, generally single-graded plain that drains eastward into Lake Huron. Areas of this soil range from 2 to about 80 acres in size. Slopes are dominantly 4 and 5 percent, and they are long and narrow. Most areas of this soil are oriented in a general east-west direction and form the side slopes of the main drainageways.

Included with this soil in mapping are many, small, moderately eroded spots. Also included is poorly drained Parkhill loam on the narrow bottoms of the main drainageways. Other inclusions are nearly level soils on the tops of ridges and at the head of drainageways and a few, short, strongly sloping spots.

The main limitations of this soil are wetness and a moderate erosion hazard. Drainage is difficult to establish and depends on the overall drainage system of the more nearly level areas. Where adequately drained, this soil is well suited to most locally adapted crops. Most areas are farmed. Capability unit IIw–5 (2.5b); woodland group 3w1.

Londo complex, 0 to 2 percent slopes (LpA).—This complex consists of somewhat poorly drained Londo loam and a thin, somewhat poorly drained, sandy soil that is underlain by loam till at a depth of 10 to 20 inches. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. The areas range from about 20 to 60 acres in size.

Londo loam makes up about 25 to 45 percent of the complex. It occurs in intermediate positions, between the highest and the lowest positions, and has very slight convex or single-graded slopes, mainly about 1 percent. The thin caplike mounds of sandy soil make up about 40 to 60 percent of the complex and occupy the highest positions in the level to nearly level landscape. The sandy areas have slightly convex slopes that are dominantly 1 to 2 percent. This thin, sandy soil is in many areas 1/8 to 3 acres in size. These areas are in spots and on mounds and knolls, scattered over the same kind of loamy underlying material that underlies Londo loam.

The profile of the Londo soil is similar to that described as typical for the series, except that in many places the plow layer is fine sandy loam. The sandy soil consists of 10 to 20 inches of fine sand or loamy fine sand over limy loam underlying materials. In most areas, just below the sand, the upper part of the underlying loam materials has a 1- to 5-inch layer that is neutral to mildly alkaline.

Included in this complex in mapping is poorly drained Parkhill loam in most of the narrow drainageways and small depressions. It normally amounts to about 5 to 10 percent of most areas. Also included is Avoca sandy loam in scattered sandy spots 1 to 3 acres in size.

Wetness and the contrasting textures of these soils are the main limitations to use. The soils are moderately suited as cropland. Uniform drainage is difficult to obtain, and tile drainage is difficult to install. The loamy areas are slow to warm up and dry out in spring, and the sandy areas are naturally low in fertility and are droughty in midsummer. Most areas of these soils are farmed. Capability unit IIIw-9 (2.5b); woodland group 3w1.

Made Land

Made land (Md) consists of manmade land areas. Some of the areas are the result of land leveling or of stripping off the upper layers of the original soils to level them for buildings, outdoor theaters, parking lots, factories, school playgrounds, and the like. Many of the areas have been made by filling in low areas or building up wet, level areas so that they are above the high water table. A few areas are dumping sites for unwanted soil materials, waste products, and debris. In all areas the original soils have been completely disturbed or buried, and the properties of the present surface and subsurface materials are unknown.

Most of the soil materials in Made land were excavated, and they range from sand and gravel to clay. Most areas have extremely variable amounts and kinds of these soil materials, and some contain broken concrete, old bricks, plaster, stones, and the like. Some areas consist of macadam that was torn up from old road beds; others consist of cinders, fly ash, silty waste, and various other industrial waste products and debris. These areas range from about 3 to 60 acres in size.

Many areas are bare or sparsely covered with weeds, and erosion by both water and wind are hazards. Because of the many different and unknown kinds of materials and their untested properties, Made land is difficult to use for most purposes. Each area requires onsite investigation before it is used intensively. Many areas are subject to uneven settling and general instability. Some areas consist of materials that are toxic to the common crops, grasses, or trees. Capability unit and woodland group not assigned.

Metamora Series

The Metamora series consists of nearly level to gently sloping, somewhat poorly drained soils. These soils formed in 18 to 40 inches of sandy loam and in the underlying clay loam till. The soils occur on undulating till plains.

In a typical profile the surface layer is very dark grayish-brown sandy loam 10 inches thick. The subsurface layer is 8 inches thick and consists of pale-brown sandy loam mottled with grayish brown, yellowish brown, and dark reddish brown. The subsoil consists of a 5-inch layer of grayish-brown, friable heavy sandy loam and an 8-inch layer of gray, firm heavy clay loam. The subsoil has small mottles of gray, yellowish brown, dark grayish brown, and olive brown. The underlying material is gray, mildly alkaline clay loam in the upper 8 inches and limy, olive-brown clay loam at a depth below 39 inches. It has small mottles of yellowish brown, light olive brown, and dark gray.

Surface runoff is slow. Permeability is moderately rapid in the sandier upper part and moderately slow in the underlying loamy part. Available water capacity is moderate. These soils are important to farming, and most crops respond well to good management. Wetness limits many nonfarm uses of these soils.

In St. Clair County the Metamora soils were mapped alone and also in a complex with the Parkhill soils.

Typical profile of Metamora sandy loam, 0 to 2 percent slopes, in a cultivated field, SE1/4SE1/4 sec. 7, T. 7 N., R. 16 E., about 50 feet north of road fence on Beard Road and 190 feet east of road sign at the junction of Abbottsford Road and Beard Road:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, medium, granular structure; very friable; slightly acid; abrupt, smooth boundary.

A2—10 to 18 inches, pale-brown (10YR 6/3) sandy loam; common, fine, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6, 5/8) mottles, and common, fine, prominent, dark reddish-brown (5YR 3/4) mottles: weak, fine, subangular blocky structure; very friable; 7 to 10 percent gravel; strongly acid; clear, wavy boundary.

B2tg—18 to 23 inches, grayish-brown (10YR 5/2) heavy sandy loam; common, fine, faint, gray (10YR 5/1) and dark grayish-brown (10YR 4/2) mottles and common, fine, distinct, yellowish-brown (10YR 5/6, 5/8) mottles; weak, medium, subangular blocky structure; friable; thin clay coatings on surfaces of peds and bridged sand grains; 7 to 10 percent gravel, and 2 to 3 percent cobblestones; medium acid; abrupt wavy boundary.

IIB2tg—23 to 31 inches, gray (10YR 5/1) heavy clay loam; many, fine, prominent, olive-brown (2.5Y 4/4) mottles and many, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure separating to weak, fine and medium, angular blocky structure; firm, thin clay films on prismatic faces of peds and few, patchy clay films on blocky faces of peds; medium acid; gradual, wavy boundary.

IIC1g—31 to 39 inches, gray (10YR 5/1) clay loam; many, fine, distinct, yellowish-brown (10YR 5/6) and light olive-brown (2.5Y 5/4) mottles and common, fine, faint, dark-gray (10YR 4/1) mottles; weak, medium and thick, platy structure; firm; mildly alkaline; abrupt, irregular boundary.

IIC2—39 to 62 inches, olive-brown (2.5Y 4/4) clay loam; many, fine, prominent, gray (10YR 5/1) and yellowish-brown (10 YR 5/6) mottles and common, fine, faint, light olive-brown (2.5Y 5/4) mottles; massive; firm; calcareous.

Depth to the IIB horizon ranges from 18 to 40 inches but is dominantly about 22 to 35 inches. The horizons of the sandy loam upper part of the profile contain 2 to 30 percent gravel and 1 to 7 percent cobblestones. The underlying loamy till material contains about 2 to 12 percent gravel and 1 to 3 percent cobblestones.

The Ap horizon ranges from 7 to 10 inches in thickness and is very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). It is sandy loam, fine sandy loam, or heavy fine sandy loam. The A2 horizon ranges from 0 to 12 inches in thickness and mainly is pale brown (10YR 6/3), grayish brown (10YR 5/2), brown (10YR 5/3), or yellowish brown (10YR 5/4). Mottles are mostly yellowish brown (10YR 5/6 and 5/8), grayish brown (10YR 5/2), dark reddish brown (5YR 3/3 and 3/4), gray (10YR 5/1), and dark gray (10YR 4/1). The A2 horizon is loamy sand, sandy loam, or fine sandy loam.

The B horizon has two or more parts in many soil profiles. It is mainly grayish brown (10YR 5/2), gray (10YR 5/1), dark grayish brown (10YR 4/2), or dark brown (10YR 4/3). Mottles are mostly olive brown (2.5Y 4/4), yellowish brown (10YR 5/4, 5/6, and 5/8), gray (10YR 5/1), grayish brown (10 YR 5/2), strong brown (7.5YR 5/6), dark brown (10YR 4/3 or 7.5YR 4/4), dark grayish brown (10YR 4/2) and brown (10YR 5/3). Texture is light to heavy sandy loam, loam, or light sandy clay loam. The Bt horizon contains thin to thick clay coatings and bridged sand grains. The IIB horizon is gray (10YR 5/1 or 5Y 5/1), dark grayish brown (10YR 4/2), or grayish brown (10YR 5/2). Mottles are approximately the same as those in the B horizon. The IIB horizon is light or heavy clay loam or silty clay loam and heavy loam. It is medium acid to mildly alkaline.

The IIC horizon is mainly gray (10YR 5/1 or 5Y 5/1), olive brown (2.5Y 4/4), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2). Mottles are mostly yellowish brown (10YR 5/4, 5/6, and 5/8), gray (10YR 5/1 or 5Y 5/1), dark brown (10YR 4/3), brown (10YR 5/3), dark gray (10YR 4/1 and 5Y 4/1), and light olive brown (2.5Y 5/4). The IIC horizon is loam, clay loam, and silty clay loam.

Metamora soils are similar to Avoca, Allendale, Wasepi, clay subsoil variant, and Metea soils. Metamora soils are finer textured in the upper part than the Avoca soils and are more deeply leached of free carbonates. They also are finer textured in the upper part than the Allendale soils and are underlain with coarser textured materials at a depth of 18 to 40 inches. They differ from Wasepi soils, clay subsoil variant, in that they are underlain with coarser textured material at a depth of 18 to 40 inches and have more acid sandy material in the upper part of the profile. Metamora soils are finer textured in the upper part than the Metea soils and have more gray mottles and dominant colors. Metamora soils are similar to Conover and Blount soils in drainage but have coarser textured materials in the upper 18 to 40 inches. The Metamora and Corunna soils developed in similar materials, but the Metamora soils are better drained. Also, within 30 inches of the soil surface, Metamora soils have a subhorizon that is brighter than is typical for the Corunna soils.

Metamora sandy loam, 0 to 2 percent slopes (MeA).—This somewhat poorly drained soil is in areas that range from 4 to 40 acres in size and have slightly convex slopes. This soil has the profile described as typical for the series. In a few places it contains a thin layer of calcareous fine sandy loam or loamy fine sand just above the underlying loamy material. In many places in the western part of the county, the underlying calcareous, loamy till is underlain by stratified, sandy to loamy materials at a depth below 48 inches.

Included with this soil in mapping are poorly drained Corunna sandy loam, Lamson fine sandy loam, and Parkhill loam that occur in small, scattered, slight depressions and narrow drainageways. Also included, in a few areas 2 to 3 acres in size, are moderately well drained sandy loams over loamy till. Other inclusions are small areas of Conover and Blount loams and small spots of well-drained Metea loamy sand on the tops of low knolls and mounds.

Wetness is the major limitation of this soil. Where adequately drained, this soil is well suited to most locally adapted crops. Most areas are farmed. Capability unit IIw–8 (3/2b); woodland group 3w1.

Metamora sandy loam, 2 to 6 percent slopes (MeB).—This somewhat poorly drained soil occupies domelike mounds, knolls, and undulating areas. These areas range from 2 to 20 acres in size and have dominantly 3 to 4 percent slopes. The profile of this soil is similar to that described for the series, except that in many places in the western part of the county, the underlying calcareous loamy till of this soil is underlain by stratified sandy and loamy materials at a depth below 48 inches.

Included with this soil in mapping are a few areas of poorly drained Parkhill loam and Corunna sandy loam that occupy the narrow drainageways and small depressions. Also included are many, small, scattered spots of loamy soils that have a sandy loam plow layer. Other inclusions are a few, small, moderately eroded spots on short slopes of 4 to 6 percent.

Wetness and a moderate erosion hazard are the chief limitations of this soil. Complete drainage systems are difficult to install because this soil is gently sloping and has an uneven surface. Where adequately drained, this soil is well suited to most locally adapted crops. Most areas are farmed. Capability unit IIw–8 (3/2b); woodland group 3w1.

Metamora-Parkhill complex, 0 to 2 percent slopes (MhA).—This complex consists of somewhat poorly drained Metamora sandy loam and poorly drained Parkhill loam. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. They occupy nearly level to very slightly undulating areas. The areas normally range from 20 to 200 acres in size. Metamora sandy loam makes up about 50 to 60 percent of the complex and occupies the higher, slightly convex mounds, knolls, and low rises. Parkhill loam makes up from 30 to 40 percent of the areas and occupies the lower, slightly concave depressions, narrow drainageways, and depressed level areas.

Included with this soil in mapping are many, small areas of a somewhat poorly drained, loamy soil that has a sandy loam surface layer. Also included are some, small, sandy spots of Avoca loamy sand. Other inclusions are of poorly drained Corunna sandy loam in small, slight depressions and narrow drainageways.

Wetness is the main limitation of these soils. Where adequately drained, these soils are well suited to most locally adapted crops. Most areas are farmed. Capability unit IIw–8 (3/2b, 2.5c); Metamora part in woodland group 3w1, Parkhill part in woodland group 3w3.

Metea Series

The Metea series consists of gently sloping, well-drained soils. These soils formed in 18 to 40 inches of fine sand to sandy loam and underlying silty clay loam over limy clay loam till. They occur on undulating till plains.

In a typical profile the surface layer is black loamy sand 3 inches thick. The subsurface layer is grayish-brown fine sand 2 inches thick. The subsoil consists of five layers. The upper three layers have a combined thickness of 28 inches.

They are strong-brown, yellowish-brown, and pale-brown, very friable to loose fine sand. The fourth layer is dark-brown, friable heavy sandy loam 6 inches thick. The fifth subsoil layer formed in the upper part of the underlying till materials and is dark-brown, firm silty clay loam 7 inches thick. The limy underlying material is brown light clay loam mottled with yellowish brown. It starts at 46 inches below the surface and extends to a depth of more than 64 inches.

Surface runoff is slow. Permeability is moderately rapid in the sandy upper part of these soils and moderately slow in the loamy lower part. Available water capacity is low. These soils are of small extent and are unimportant to farming. They have few limitations for nonfarm uses.

Typical profile of Metea loamy sand, 2 to 6 percent slopes, in a wooded area, SE¼SE¼SW¼, sec. 10, T. 7 N., R. 16 E., about 100 feet west of the east edge of the woodlot and 150 feet south of the north edge:

A1—0 to 3 inches, black (10YR 2/1) loamy sand; weak, medium, granular structure; very friable; very strongly acid; abrupt, smooth boundary.

A2—3 to 5 inches, grayish-brown (10YR 5/2) fine sand; very weak, medium, platy structure separating to single grain; very friable and loose; very strongly acid; abrupt, irregular boundary.

B21—5 to 15 inches, strong-brown (7.5YR 5/6) fine sand; very weak, medium, subangular blocky structure separating to single grain; very friable and loose; strongly acid; gradual, wavy boundary.

B22—15 to 24 inches, yellowish-brown (10YR 5/4) fine sand; single grain; loose; medium acid; clear, wavy boundary.

B23—24 to 33 inches, pale-brown (10YR 6/3) fine sand; single grain; loose; medium acid; abrupt, irregular boundary.

B24t—33 to 39 inches, dark-brown (7.5YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure; friable; thin clay films on surfaces of peds and bridging of sand grains; slightly acid; abrupt, wavy boundary.

IIB25t—39 to 46 inches, dark-brown (10YR 4/3) silty clay loam; weak, medium, angular blocky structure; firm; thick clay films on most surfaces of peds and along old root channels and cracks; slightly acid; abrupt, wavy boundary.

IIC—46 to 64 inches, brown (10YR 5/3) light clay loam; common, fine, faint, yellowish-brown (10YR 5/6) mottles; massive; friable; calcareous.

Thickness of the sandy upper part of the profile ranges from 18 to 40 inches and is extremely variable within short horizontal distances. The solum ranges from very strongly acid to slightly acid throughout the upper part and from slightly acid to mildly alkaline throughout the lower part. In cultivated areas the Ap horizon is 6 to 10 inches thick. This horizon is dark brown (10YR 3/3) or very dark grayish brown (10YR 3/2). The A horizon ranges from loamy sand to sand or fine sand.

The B21 and B22 horizons are strong brown (7.5YR 5/6), brown (7.5YR 5/4), or yellowish brown (10YR 5/4). These horizons range from sand to loamy sand or from fine sand to loamy fine sand. The B24t horizon is absent in a few profiles, but normally it ranges from 1 to 15 inches in thickness. The B24t horizon ranges from loamy sand to light sandy clay loam. The IIB25t horizon ranges from 2 to 18 inches in thickness. This horizon is loam, silt loam, clay loam, or silty clay loam.

The IIC horizon is loam, silt loam, silty clay loam, or clay loam.

Metea soils formed in materials similar to those of Avoca soils but have a brighter colored, more acid, sandy subsoil than Avoca soils and finer textured lower layers. Metea soils occur near Metamora and Corunna soils. The sandy upper part of Metea soils is coarser textured than that of Metamora or Corunna soils and has fewer gray mottles or colors. Metea soils are similar to the Allendale soils. Metea soils are better drained than Allendale soils and have a brighter colored, sandy subsoil and coarser textured underlying material at a depth of 18 to 40 inches. Metea soils formed in sand underlain by loamy materials at a depth of 18 to 40 inches, whereas the Spinks, Chelsea, and Eastport soils formed in deep sand and lack the finer textured underlying materials, though their drainage is similar to that of Metea soils.

Metea loamy sand, 2 to 6 percent slopes (MfB).—This well-drained soil is on low, convex ridges, on domelike mounds, and in undulating areas. These areas range from 2 to about 30 acres in size. The smaller areas are generally longer than they are wide, and they occupy high points in the landscape. The larger areas range from caplike, irregularly shaped mounds to gently undulating, long, wide, irregularly shaped areas. In some places these areas form an intermittent line or pattern several miles long across the general landscape.

Included with this soil in mapping are many small spots where the loamy underlying material is at a depth of less than 18 inches and more than 40 inches. Also included are a few strongly sloping spots.

A moderate erosion hazard, low natural fertility, and low available water capacity are the major limitations of this soil. This soil is generally troublesome in normal tillage operations because it occurs as small, scattered areas in close association with loamy soils. It is droughty and subject to moderate erosion by both water and wind. This soil is moderately suited to most crops. Most areas are not farmed and are mainly wooded or brush covered. Capability unit IIIs–4 (4/2a); woodland group 3s1.

Miami Series

The Miami series consists of nearly level to sloping, well-drained soils. These soils formed in limy clay loam glacial till. They occur in gently undulating to gently rolling areas on the moraines.

In a typical profile the surface layer is dark grayish-brown loam 9 inches thick. The subsoil is 21 inches thick. The upper 4-inch layer of the subsoil is pale-brown, firm light clay loam. The middle layer is dark-brown, firm clay loam 10 inches thick. The lowest layer is dark grayish-brown, firm silty clay loam 7 inches thick. The limy underlying material is yellowish-brown light clay loam.

Surface runoff is slow to rapid, depending on the steepness of slope. Permeability is moderately slow. Available water capacity is high. These soils are of small extent in the county, but they are locally important to farming. Crops respond well to good management. These soils have few limitations for nonfarm uses.

In St. Clair County the Miami soils were mapped alone and also in complexes with the Dighton soils.

Typical profile of Miami loan, 6 to 12 percent slopes, in a cultivated field, in the NE¼SE¼NE¼NW¼ sec. 12, T. 8 N., R. 13 E., about 100 feet west of north-south fence and 100 feet south of old east-west fence:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loam; moderate, fine, subangular blocky structure; friable; 5 percent coarse fragments; neutral; abrupt, smooth boundary.

B21—9 to 13 inches, pale-brown (10YR 6/2) light clay loam; weak, medium, prismatic structure separating to moderate, medium and coarse, angular blocky structure; firm; all vertical prismatic surfaces of peds and many of the coarse blocky peds have thin coatings of silt and very fine sand; horizon contains a few A2 tongues ¼ to 1 inch wide; interiors of peds are strong brown

(7.5YR 5/6), yellowish brown (10YR 5/4), and dark yellowish brown (10YR 4/4); the A2 tongues are less than 10 percent of horizon; 5 percent coarse fragments; slightly acid; abrupt, irregular boundary.

B22t—13 to 23 inches, dark-brown (10YR 4/3) clay loam; weak, medium, prismatic structure separating to weak and moderate, thick, platy structure; firm; thin, yellowish-brown (10YR 5/6) clay films on all vertical prismatic faces of peds and thin, patchy clay films on most interior blocky faces; grayish-brown (10YR 5/2), grainy coatings on vertical faces; 5 percent coarse fragments; medium acid; clear, wavy boundary.

B23t—23 to 30 inches, dark grayish-brown (10YR 4/2) silty clay loam; weak, medium, prismatic structure separating to moderate, thick, platy structure; firm; all surfaces of peds have thin, yellowish-brown (10YR 5/6) clay films; patchy, grayish-brown (10 YR 5/2), grainy coats on vertical faces of peds; 5 percent coarse fragments; mildly alkaline; abrupt, wavy boundary.

C—30 to 62 inches, yellowish-brown (10YR 5/4) light clay loam; many, fine, faint, grayish-brown (10YR 5/2), gray (10YR 5/1), and yellowish-brown (10YR 5/6) mottles; weak, thick, platy structure grading to massive with depth; friable; contains streaks and spots of light-gray (10YR 7/2) secondary lime; 5 percent coarse fragments; calcareous.

The solum is dominantly 24 to 34 inches thick but ranges from 24 to 45 inches in thickness. It ranges from strongly acid to neutral throughout the upper horizons and from medium acid to mildly alkaline throughout the lower horizons. Coarse fragments throughout the soil profile range from 5 to 10 percent gravel and from 1 to 3 percent cobblestones.

The Ap horizon ranges from 6 to 10 inches in thickness and is dark grayish brown (10YR 4/2). The Ap horizon is loam or sandy loam. In a few profiles an A2 horizon occurs and is yellowish brown (10YR 5/4), light yellowish brown (10YR 6/4), or pale brown (10YR 6/3). It is sandy loam or loam.

The B21 horizon is in a few profiles and is represented by a B&A horizon that has more than 10 percent of A2 horizon materials. The color of the B21 horizon is dominated by the pale-brown (10YR 6/3), yellowish-brown (10YR 5/4), or light yellowish-brown (10YR 6/4) A2 horizon material that coats most of the faces of peds. Interiors of the peds have finely mottled colors of strong brown (7.5YR 5/6), dark yellowish brown (10YR 4/4), and yellowish brown (10YR 5/4). Texture is mostly light clay loam that has thin silt and very fine sand coatings on most surfaces of peds. The B22t horizon is dark brown (10YR 4/3 or 7.5YR 4/4) or dark yellowish brown (10YR 4/4). It has thin coatings and patches of yellowish-brown (10YR 5/6) clay on vertical and interior ped faces and grayish-brown (10YR 5/2), grainy coatings on vertical faces. The B22t horizon is clay loam or light silty clay loam. The B23t horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3 or 7.5YR 4/4). It is clay loam or silty clay loam. The B2t horizon averages between 32 and 34 percent clay. Structure of the B2t horizon is mostly weak, coarse, prismatic separating to weak and moderate, thick, platy, or moderate, medium and coarse, angular blocky. In a few profiles, the prismatic structure is absent.

The C horizon is mainly yellowish brown (10YR 5/4). It is loam or silt loam or light clay loam. In a few profiles, it is mildly alkaline in the uppermost 10 inches, but it is mostly calcareous.

Miami soils occur near areas of Morley and Dighton soils. Miami soils have a coarser textured subsoil (less than 35 percent clay) and underlying materials than the Morley soils. The Miami soils have a solum similar to that of Dighton soils, but Miami soils are underlain by loamy till and Dighton soils are underlain by sandy materials at a depth of 24 to 40 inches. Although developed in materials similar to those of Conover and Londo soils, the Miami soils are better drained, lack the gray mottles in the upper part of the subsoil, and have a lighter colored plow layer.

Miami loam, 6 to 12 percent slopes (MmC).—This well-drained soil has slopes that are dominantly 8 to 10 percent. It occurs mostly as knoblike hills or as side slopes along major drainageways. It is in areas that range from 3 to 8 acres in size. This soil has the profile described as typical for the series.

Included with this soil in mapping are a few short, steep, severely eroded areas and some small, gently sloping areas on the tops or crowns of hills and narrow ridges. Also included are somewhat poorly drained Conover and Blount loam in many narrow drainageways. Other inclusions are a few small spots where sandy loam is 18 to 40 inches thick.

A moderately severe erosion hazard is the main limitation of this soil. The soil is moderately well suited to most locally adapted crops. Most areas have been cleared and are farmed. Capability unit IIIe-5 (2.5a); woodland group 2o1.

Miami-Dighton sandy loams, 0 to 2 percent slopes (MnA).—This complex consists of well-drained Miami sandy loam and well-drained Dighton sandy loam. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. Miami sandy loam makes up about 50 percent of the complex, and Dighton sandy loam makes up the other 50 percent. These soils occupy similar positions in the landscape, and the main differences between them are in their soil profiles. The profiles are similar to those described for each series, except that the plow layer of the Miami soil is sandy loam and the plow layer of the Dighton is loamy sand in a few areas.

Included in this complex in mapping are many small areas where Miami sandy loam is underlain by sandy materials below a depth of 48 inches. Also included, in areas of both the Miami and the Dighton soils, are small, moderately well drained areas. Other inclusions are small, scattered spots of sandy loam 18 to 40 inches thick.

These soils are well suited to most locally adapted crops. They have very few limitations. Nearly all areas of this mapping unit are farmed. Capability unit I-1 (2.5a, 1.5a); woodland group 2o1.

Miami-Dighton sandy loams, 2 to 6 percent slopes (MnB).—This complex consists of well-drained Miami sandy loam and well-drained Dighton sandy loam. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. They are gently sloping and undulating. The slopes are dominantly 3 to 4 percent, and the areas range from about 4 to 20 acres in size. Miami sandy loam makes up about 50 percent of the complex, and Dighton sandy loam makes up the other 50 percent. These occupy similar positions in the landscape, and the main differences between them are in their profiles. The profiles are similar to those described for each series, except that the plow layer of the Miami soil is sandy loam and that of the Dighton soil is loamy sand in a few areas.

Included in this complex in mapping are many small areas where the Miami soil is underlain by sandy materials below a depth of 48 inches and small, moderately well drained areas in both the Miami and Dighton sandy loams. Also included are many, small, scattered spots where sandy loam is 18 to 40 inches thick. Other inclusions are small, moderately eroded spots, commonly having slopes of 4 to 6 percent. In a few areas, normally along drainageways, a few short slopes of 7 to 9 percent are included.

The main limitation of these soils is the moderate erosion hazard. These soils are well suited to most locally adapted crops. Nearly all areas are farmed. Capability unit IIe–2 (2.5a, 1.5a); woodland group 2o1.

Minoa Series

The Minoa series consists of nearly level to gently sloping, somewhat poorly drained soils. These soils formed in stratified, limy, water-laid sediments of very fine sandy loam, silt loam, and loamy very fine sand. Areas are gently undulating and occur on lake plains, on stream terraces, and in glacial drainageways.

In a typical profile the surface layer is very dark grayish-brown fine sandy loam 9 inches thick. The subsoil consists of three layers that have a combined thickness of 25 inches. The uppermost layer is yellowish-brown, very friable fine sandy loam that has many, fine, grayish-brown and light olive-brown mottles and is 10 inches thick. The middle layer is yellowish-brown, very friable loamy fine sand that has grayish-brown mottles and is 3 inches thick. The lowest layer is light olive-brown, friable silt loam that has grayish-brown, gray, and yellowish-brown mottles and is 12 inches thick. The limy underlying materials are layers of yellowish-brown or light olive-brown very fine sandy loam, silt loam, and loamy fine sand. The layers are mottled with light gray, grayish brown, yellowish brown, and light olive brown.

Surface runoff is slow. Permeability and the available water capacity are moderate. These soils are important locally to farming. Wetness limits many nonfarm uses.

In this county the Minoa soils were mapped alone and in a complex with the Lamson soils.

Typical profile of Minoa fine sandy loam, 0 to 2 percent slopes, in a cultivated field, NW¼NW¼NE¼NE¼ sec. 7, T. 8 N., R. 15 E., about 100 feet south of Jeddo Road and 60 feet east of fence line:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

B21—9 to 19 inches, yellowish-brown (10YR 5/4) fine sandy loam; many, fine, distinct, grayish-brown (2.5Y 5/2), light olive-brown (2.5Y 5/4), and yellowish-brown (10YR 5/6) mottles; weak, medium, platy structure; very friable; 2 to 5 percent fine gravel; neutral; abrupt, irregular boundary.

B22—19 to 22 inches, yellowish-brown (10YR 5/4) loamy fine sand; many, medium, distinct, grayish-brown (10YR 5/2), and yellowish-brown (10YR 5/6) mottles; very weak, medium, platy structure; very friable; 3 to 7 percent fine gravel; neutral; abrupt, irregular boundary.

B23—22 to 34 inches, light olive-brown (2.5Y 5/4) silt loam; many, fine, distinct, grayish-brown (2.5Y 5/2), yellowish-brown (10YR 5/4 and 5/6), and gray (10YR 5/1) mottles; very weak, thick, platy structure; friable; neutral; abrupt, wavy boundary.

C1—34 to 41 inches, yellowish-brown (10YR 5/4) very fine sandy loam; common, fine, faint and distinct, light-gray (10YR 6/1), grayish-brown (10YR 5/2), and light olive-brown (2.5Y 5/4) mottles; very weak, thick, platy structure; friable and very friable; calcareous; gradual, wavy boundary.

C2—41 to 58 inches, yellowish-brown (10YR 5/4), stratified very fine sandy loam and silt loam; common, fine, faint and distinct, light-gray (10YR 6/1), grayish-brown (10YR 5/2), and light olive-brown (2.5Y 5/4) mottles; massive; very friable; calcareous; clear, wavy boundary.

C3—58 to 62 inches, light olive-brown (2.5Y 5/4) loamy very fine sand; common, fine, faint, yellowish-brown (10YR 5/6) and grayish-brown (2.5Y 5/2) mottles; massive; very friable; calcareous.

The solum ranges from 30 to 39 inches in thickness. It ranges from medium acid to neutral throughout the upper part and from slightly acid to mildly alkaline throughout the lower part. The Ap horizon ranges from 7 to 10 inches in thickness and is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or very dark brown (10YR 2/2). Texture is fine sandy loam, very fine sandy loam, loam, and silt loam.

The B horizons range from 15 to 29 inches in thickness. Texture, thickness, and sequence of the layers are variable within short horizontal distances. The B21 horizon is mainly yellowish brown (10YR 5/4), brown (10YR 5/3), and light olive brown (2.5Y 5/4). It is mottled mostly with grayish brown (10YR 5/2 or 2.5Y 5/2), yellowish brown (10YR 5/6 and 5/8), and light olive brown (2.5Y 5/4). The B22 and B23 horizons are mainly yellowish brown (10YR 5/4), light olive brown (2.5Y 5/4), brown (10YR 5/3), and grayish brown (10YR 5/2 or 2.5Y 5/2). Depending on the dominant color of the B22 or B23 horizon, the mottles are mainly a combination of the other colors stated for the B22 and B23 horizons and also yellowish brown (10YR 5/6), gray (10YR 5/1), and light gray (10YR 6/1 or 2.5Y 6/1). The B horizon is mostly fine sandy loam, very fine sandy loam, loamy very fine sand, silt loam, loam, and loamy fine sand. A few soil profiles have thin layers of light clay loam, silty clay loam, very fine sand, and sand. Between depths of 10 and 40 inches, the material is less than 18 percent clay and the very fine sand and silt together make up 40 to 80 percent. Structure of the B horizon ranges from weak, platy to weak, subangular blocky.

The colors of the C horizon are about the same as those of the B22 and B23 horizons and also gray (10YR 5/1 or 5Y 5/1) and light gray (10YR 6/1 or 2.5Y 6/1). The C horizon has about the same texture as the B horizon, but a few profiles also have fine sand, loamy sand, and sand layers.

In this county calcareous material in Minoa soils is a few inches closer to the soil surface than in the defined range for the series, but this difference does not alter their usefulness or behavior.

Minoa soils are similar to Sanilac, Wainola, and Wasepi soils in drainage. They lack the limy material that occurs in the solum of the Sanilac soils. Minoa soils have a finer textured subsoil and underlying materials than Wainola soils. Minoa soils formed in lacustrine material that contains finer sand, more silt, and less gravel than the material in which the Wasepi soils formed. Minoa soils formed in materials similar to those of Lamson soils, but Minoa soils are less gray just below the plow layer and are better drained than the Lamson soils.

Minoa fine sandy loam, 0 to 2 percent slopes (MoA).—This somewhat poorly drained soil occupies areas that range from 4 to 80 acres in size and from long and narrow to wide and irregular in shape. The slopes are dominantly 1 percent and slightly convex or single graded. Some areas in narrow drainageways have slightly concave slopes and overall gradients of 1 or 2 percent. This soil has the profile described as typical for the series.

Included with this soil in mapping are small spots of Wainola loamy fine sand that lacks the loamy layers of Minoa fine sandy loam and, therefore, is more droughty. Also included is poorly drained Lamson fine sandy loam in some of the small depressions and narrow drainageways. Included around the outer edges of this mapping unit are narrow strips and spots of soil underlain by loamy till materials or heavy lacustrine clays.

Wetness and strata of silt and fine sandy materials are the main limitations of this soil. Drainage is difficult to establish because the silt and fine sand tend to flow when wet and to plug tile lines and cause ditchbanks to slough. Where adequately drained, this soil is well suited to most locally adapted crops. Most areas have been cleared and are farmed. The remaining wooded areas have stands of second-growth hardwoods. Capability unit IIw–6 (3b); woodland group 3w1.

Minoa fine sandy loam, 2 to 6 percent slopes (MoB).—This somewhat poorly drained soil occupies domelike mounds, low ridges, and undulating areas. These range from 2 to 60 acres in size and are long and narrow to wide and irregular. Slopes are short and mainly 3 or 4 percent.

Included with this soil in mapping are small, more sloping spots where the soil is moderately well drained but has a profile similar to that of this soil. Also included are a few areas of poorly drained Lamson fine sandy loam on the bottoms of narrow drainageways and depressions. Other inclusions are a few short, strong slopes bordering drainageways.

The main limitations of this soil are wetness and a moderate erosion hazard. Drainage is difficult to establish because of the small areas and the fine sand and silt content. If adequately drained, this soil is well suited to most locally adapted crops. Most areas are farmed, though many small areas are wooded. Capability unit IIw–6 (3b); woodland group 3w1.

Minoa fine sandy loam, clay substratum, 0 to 3 percent slopes (MrA).—This somewhat poorly drained soil is level to very gently sloping and undulating. Slopes are dominantly 2 percent and slightly convex. The areas range from long and narrow to wide and irregular in shape. The profile of this soil is similar to that described for the Minoa series, except that clay and silt loam layers occur at a depth of 30 to 50 inches.

Included with this soil in mapping are many spots that are limy at or near the surface. Also included are small areas of Minoa fine sandy loam that does not have the clay substratum. Other inclusions are small, poorly drained depressions where the profile is similar to that of this soil.

The main limitations of this soil are wetness and the very slow permeability of the underlying clay. Drainage is difficult to establish because of the small areas, the silt and fine sand content, and the very slow permeability of the underlying clay. Where adequately drained, this soil is well suited to most locally adapted crops. Small areas are troublesome in tillage operations where the areas are in close association with larger areas of clay soils. Wooded areas are small and scattered. Capability unit IIw–6 (3/1b); woodland group 3w1.

Minoa-Lamson complex, 0 to 3 percent slopes (MsA).—The soil complex consists of somewhat poorly drained Minoa loam and poorly drained Lamson silt loam. These soils occur next to each other in areas too small to be mapped separately. They occupy the second bottoms or terraces along the flood plains of the major rivers and other streams. Areas normally are very gently undulating. They range from 2 to about 40 acres in size. Minoa loam makes up about 60 to 70 percent of the complex and occupies the higher slightly convex mounds, knolls, and rises. Lamson silt loam makes up about 20 to 30 percent of the areas and occupies the slightly concave depressions, narrow drainageways, and depressed flats. The profile of each soil is similar to that described for its respective series, except that the Minoa soil has a loam surface layer and the Lamson soil has a silt loam surface layer. Both soils have thicker, more acid profiles than is typical for these series.

Included with this complex in mapping are many small knolls, low ridges, and mounds of moderately well drained and somewhat poorly drained, stratified, sandy soils. Also included are small areas of stratified silty clay loam soils that are somewhat poorly drained and poorly drained. In many areas remnants of the old river channels or meanders that have very short, steep banks are included.

The major limitations of these soils are wetness and flooding. Lack of an adequate outlet severely limits the possibility of draining these areas with tile. The hazard of flooding, though less than on the first bottoms, is mostly early in spring. These soils are flooded from one to three times a year and for periods that last from 1 to 12 days. Some flooding occurs in seasons other than spring, but generally these floods are infrequent and of short duration. Many areas of these soils are relatively inaccessible because of the meandering river and the bordering steep river bluffs and escarpments. These soils are moderately suited to some locally adapted crops. Many areas are wooded. Capability unit IIIw–12 (3b–3c); Minoa part in woodland group 3w1, Lamson part in woodland group 4w1.

Morley Series

The Morley series consists of sloping to strongly sloping, well drained and moderately well drained soils. These soils formed in limy clay loam glacial till. They occur in rolling areas on the moraines and till plains.

In a typical profile the surface layer is dark grayish-brown loam 6 inches thick. The uppermost layer of the subsoil is a mixture of dark-brown, firm clay loam and brown, friable loam 6 inches thick. The middle layer is dark-brown, very firm light clay 8 inches thick. The lowest layer of the subsoil is limy, dark-brown, firm heavy clay loam 4 inches thick. The limy underlying material consists of brown light clay loam and clay loam that is mottled with grayish brown and yellowish brown.

Surface runoff is rapid, permeability is slow, and available water capacity is high. These soils have limited importance for farming because of the steepness of slopes and the hazard of erosion. Slow permeability and the steepness of slopes limits some nonfarm uses of these soils.

Typical profile of Morley loam, 6 to 12 percent slopes, eroded, in a cultivated field, NE¼NE¼SE¼ sec. 15, T. 7 N., R. 16 E., about 500 feet south of Highway M–136 and Vincent Road junction and 20 feet west of the north-south fence along Vincent Road:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

B&A—6 to 12 inches, the B part, dark-brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; all peds have thin to thick films of A2 material; the A part, brown (10YR 5/3) loam; weak, fine, subangular blocky structure; friable; occurs as thin to thick films on the surface of all peds of the B part and as ⅛- to 1-inch wide, fingerlike fillings of cracks and old root channels; slightly acid; clear, smooth boundary.

B21t—12 to 20 inches, dark-brown (7.5YR 4/4) light clay; weak, coarse, prismatic structure separating to moderate, medium and coarse, angular blocky structure; very firm, thin clay films on all surfaces of peds and dark grayish-brown (10YR 4/2) clay flows and linings along cracks and old root channels; neutral; clear, smooth boundary.

B22t—20 to 24 inches, dark-brown (7.5YR 4/4) heavy clay loam; very weak, coarse, prismatic structure separating to weak, medium, angular blocky structure; firm;

few thin clay films on some surfaces of peds and flows along cracks and old root channels; calcareous; clear, wavy boundary.

C1—24 to 28 inches, brown (10YR 5/3) light clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles and common, fine, faint, grayish-brown (10YR 5/2) mottles; weak, medium and thick, platy structure; firm; calcareous; clear, smooth boundary.

C2—28 to 62 inches, brown (10YR 5/3) clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles and common, fine, faint, grayish-brown (10YR 5/2) mottles; weak, thick, platy structure; firm; light brownish-gray (10YR 6/2) and gray (10YR 6/1) spots and streaks of secondary lime; calcareous.

The solum dominantly is about 20 to 26 inches thick but ranges from 14 to 31 inches in thickness. It ranges from slightly acid to neutral throughout the upper part and from slightly acid to mildly alkaline (calcareous) throughout the lower part. In forested areas there is a very dark brown (10YR 2/2) or black (10YR 2/1) loam A1 horizon 2 to 4 inches thick. The Ap horizon ranges from 6 to 8 inches in thickness and is mainly dark grayish brown (10YR 4/2). It is loam, heavy loam, or silt loam. The A2 horizon is absent in many soil profiles in cultivated areas. If an A2 horizon does occur, it is brown (10YR 5/3 or 7.5YR 5/4) or yellowish-brown (10YR 5/4) loam, and it interfingers and coats the faces of peds in the upper part of the B horizon.

The B&A horizon is absent in a few profiles, but if it is present it ranges from 3 to 7 inches in thickness. The A2 part occurs as thin to thick films on most faces of peds in the B horizon and as 1/16-inch to 1½-inch, fingerlike fillings of the vertical cracks. Color and texture of the A2 part are the same as those given for the A2 horizon. The B part of the B&A horizon is dark-brown (7.5YR 4/4 or 10YR 4/3) light clay loam or clay loam. The prismatic structure in the B&A horizon is absent in a few profiles.

The B2t horizon is dark yellowish brown (10YR 4/4), dark grayish brown (10YR 4/2), or dark brown (10YR 4/3, 7.5YR 4/4, or 7.5YR 4/2). It is heavy clay loam or silty clay loam and light clay or silty clay. The B2t horizon averages between 35 and 45 percent clay. The prismatic structure in the B2t horizon is absent in a few profiles. Structure ranges from medium and coarse, angular blocky to medium and thick, platy, and the grades are weak to moderate. The B2 horizon is absent in a few profiles, but where present, it is dark brown (7.5YR 4/4 or 10YR 4/3) or yellowish brown (10YR 5/4). The B3 horizon in a few profiles is mottled with grayish brown (10YR 5/2), gray (10YR 5/1), and yellowish brown (10YR 5/6). The prismatic structure is absent in many profiles. If no prismatic structure occurs, the main structure is weak to moderate, platy or angular blocky.

The C horizon is mainly brown (10YR 5/3) or yellowish brown (10YR 5/4) mottled mostly with light brownish gray (10YR 6/2), grayish brown (10YR 5/2), light gray (10YR 6/1), and yellowish brown (10YR 5/6). Texture is clay loam and silty clay loam.

Morley soils occur near areas of Pert, Blount, Dighton, and Miami soils. Morley soils have better drainage and less gray colors in the upper part of the subsoil than the Pert or Blount soils. The texture of the underlying materials of Morley soils is finer than that of the Dighton soils. The Morley soils have finer texture than the Miami soils in the finest part of the subsoil.

Morley loam, 6 to 12 percent slopes, eroded (MtC2).—This well drained and moderately well drained soil generally occurs on narrow side slopes that border depressed drainageways or on boundaries between upland till plains and lowland lake plains, old glacial drainage channels, or river flood plains. Slopes range from 50 to 200 feet in length and are dominantly 8 to 10 percent. Areas of this soil range from 2 to 20 acres in size. This soil has the profile described as typical for the series.

Included with this soil in mapping are a few areas of Morley soils that have a sandy loam plow layer. Also included are a few, short, steeply sloping spots of dark-brown, severely eroded clay loam less than 1 acre in size. Other inclusions are small areas of somewhat poorly drained Blount loam in the bottoms of narrow drainageways. Along the bottoms of deeply depressed drainageways are narrow strips of poorly drained Sims loam and Parkhill loam. Level to nearly level areas on tops of mounds and ridges are also included.

A moderately severe erosion hazard is the main limitation of this soil. The soil is moderately well suited to most locally adapted crops, and most areas are farmed. Capability unit IIIe-4 (1.5a); and woodland group 3c1.

Morley loam, 12 to 18 percent slopes, eroded (MtD2).—This soil generally occurs as short, ridgelike side slopes that border deeply depressed drainageways. Slopes are dominantly 15 to 17 percent and 75 to 250 feet long. Areas of this soil range from 2 to 10 acres in size. The profile of this soil is similar to that described for the series except for the plow layer. Because soil material has been lost through erosion, the surface layer and some of the upper part of the subsoil are mixed and form a dark-brown heavy loam plow layer about 6 inches thick.

Included with this soil in mapping are a few steep and very steep areas. Also included are small areas of well-drained sandy loam soils that are 18 to 40 inches thick over loamy till materials. Other inclusions are a few areas of Metea loamy sand on small caplike mounds on the top parts of the slopes. Inclusions on the upper parts of the steeper slopes are some severely eroded spots where the dark-brown clay loam and clay subsoil is exposed.

A severe erosion hazard and the strong slopes are the main limitations of this soil. The soil is poorly suited to intensive cropping. Tillage and harvesting operations are hindered because of the strong, short slopes. Most areas of this soil are farmed. Capability unit IVe-1 (1.5a); woodland group 3c1.

Nappanee Series

The Nappanee series consists of nearly level, somewhat poorly drained soils. These soils formed in limy clay glacial till materials. They occur on undulating ground moraines and water-laid moraines.

In a typical profile the surface layer is dark grayish-brown loam 8 inches thick. The subsurface layer is brown heavy loam 2 inches thick. The subsoil is dark grayish-brown, firm clay that is 7 inches thick and is mottled with grayish brown, yellowish brown, dark brown, and dark yellowish brown. The underlying material is limy gray clay that has brown, dark-brown, and olive-brown spots.

Surface runoff is slow. Permeability is slow, and the available water capacity is moderate. Most areas of the Nappanee soils are cultivated, but farming is limited by wetness and by the intricate association of these soils with very poorly drained Hoytville soils. These clayey, slowly permeable Nappanee soils have severe limitations for many nonfarm uses.

In St. Clair County the Nappanee soils were mapped only in a complex with the Hoytville soils.

Typical profile of a Nappanee loam in an area of Nappanee-Hoytville complex, 0 to 3 percent slopes, in a cultivated field on the south side of Davis Road, about one-quarter mile west of Highway M-29, sec. 18, T. 5 N., R. 17 E.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loam, light brownish gray (10YR 6/2) when dry; very weak, coarse, granular structure; friable; slightly acid; abrupt, irregular boundary.

A2—8 to 10 inches, brown (10YR 5/3) heavy loam; few, fine, faint, grayish-brown (10YR 5/2) mottles and few, fine, distinct, yellowish-brown (10YR 5/6) mottles; very weak, thick, platy structure; very friable; slightly acid; abrupt, broken and discontinuous boundary.

B2tg—10 to 17 inches, dark grayish-brown (10YR 4/2) clay; common, fine, faint, grayish-brown (10YR 5/2) mottles and many, fine, distinct, yellowish-brown (10YR 5/6), dark yellowish-brown (10YR 4/4), and dark-brown (10YR 4/3) mottles; moderate, medium, prismatic structure separating to moderate, fine and medium, angular blocky structure; firm; brown (7.5Y 4/2), thin clay films on a few surfaces of peds; neutral; abrupt, wavy boundary.

Cg—17 to 62 inches, gray (5Y 5/1) clay; many, medium, prominent, brown (10YR 5/3), dark-brown (10YR 4/3), and olive-brown (2.5Y 4/4) mottles; very weak, medium, prismatic structure separating to very weak, medium, angular blocky structure in the upper part and grading to massive in the lower part; firm; many, thin, light-gray (10YR 6/1 and 7/1) streaks of secondary lime; about 3 percent gravel; calcareous.

The solum is dominantly 15 to 18 inches thick but ranges from 12 to 32 inches in thickness. The Ap horizon is 6 to 9 inches thick. It is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2) when moist and is light brownish gray (10YR 6/2) when dry. The Ap horizon is heavy loam or silt loam and is medium acid to slightly acid. The A2 horizon is absent in a few soil profiles. If present, the A2 horizon is brown (10YR 5/3), mottled heavy loam or silt loam.

The B horizon is mainly dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or dark brown (10YR 4/3). It is clay or silty clay. The Bt horizon has an average clay content of between 45 and 50 percent. It generally has weak to moderate prismatic structure, but this structure is absent in a few profiles. The B horizon ranges from slightly acid to neutral.

The C horizon is mainly gray (10YR 5/1 or 5Y 5/1) or brown (10YR 5/3 or 4/3). Mottles are yellowish brown (10YR 5/4 and 5/6) and olive brown (2.5Y 4/4) if the matrix is gray. Mottles are yellowish brown (10YR 5/6), dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and gray (10YR 5/1) if the matrix is brown. The C horizon is clay, silty clay, or heavy silty clay loam, and its clay content ranges from 38 to 45 percent.

The solum (A and B horizons) of Nappanee soils in St. Clair County is a few inches thinner than the defined range for the series, but this difference does not alter their usefulness and behavior.

Nappanee soils are similar to Conover and Blount soils in drainage. They have a finer textured subsoil and underlying materials than the Conover soils. Nappanee soils are finer textured under the subsoil than the Blount soils. The Nappanee soils developed in material similar to that of the Hoytville soils, but Nappanee soils are better drained and have less gray within 30 inches of the soil surface.

Nappanee-Hoytville complex, 0 to 3 percent slopes (NhA).—This soil complex consists of somewhat poorly drained Nappanee loam and very poorly drained Hoytville silty clay loam. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. They are nearly level to very gently undulating. Areas range from about 10 to 600 acres in size. Nappanee loam makes up about 40 to 55 percent of this complex and occupies the higher, slightly convex mounds, knolls, and low rises. Hoytville silty clay loam makes up about 30 to 45 percent of the areas and occupies the lower, slightly concave depressions, narrow drainageways, and depressed level areas.

Included in this complex in mapping are a few, small, scattered areas of Allendale loamy fine sand, Blount loam, and Lenawee silt loam. Somewhat poorly drained Allendale loamy fine sand has 18 to 40 inches of sandy material over clay. Somewhat poorly drained Blount loam is less clayey than Nappanee loam. Lenawee silt loam has thin layers of very fine sandy loam and silt loam in the substratum. Also included are a few areas of small, long, low, ridgelike mounds of gravelly sandy loam that is 18 to 40 inches thick over clay. Other inclusions are small areas of moderately well drained clayey soils that are similar to the Nappanee soil. These clayey inclusions occur on short slopes of 4 and 5 percent and on the strong slopes.

Wetness and the slow permeability are the main limitations of this complex. Drainage is difficult to establish. The soils are moderately suited to most crops. Ponded surface water and poor soil tilth are limitations for farming, but most areas of this complex are farmed. Capability unit IIIw-2 (1b, 1c); Nappanee part in woodland group 3w1, Hoytville part in woodland group 3w3.

Otisco Series

The Otisco series consists of nearly level, somewhat poorly drained soils. These soils formed in sandy materials. They occur on gently undulating till plains, on outwash plains, and in glacial drainageways.

In a typical profile the surface layer is very dark gray loamy sand 8 inches thick. The subsoil consists of five layers and has a total thickness of 40 inches. The upper layer, 6 inches thick, is dark yellowish-brown, very friable loamy sand that is mottled with strong brown and grayish brown. The next layer is 8 inches thick and consists of thin, alternating lenses and layers of pale-brown, loose sand and dark-brown, friable loamy sand mottled with grayish brown. The next layer is 7 inches thick and is brown, very friable light loamy sand mottled with yellowish brown and grayish brown. The lower part of the subsoil consists of dark yellowish-brown, very friable sandy loam that is 8 inches thick and dark-brown, very friable loamy sand that is 11 inches thick. Both layers have grayish-brown and yellowish-brown mottles. The underlying materials are dark-brown sand that is mottled with grayish brown and pale brown and is 12 inches thick and limy, light brownish-gray sand and very coarse sand 6 inches thick.

Surface runoff is slow. The permeability is rapid. Available water capacity is low. These soils are of small extent but are locally important to farming. Wetness limits many nonfarm uses.

Typical profile of Otisco loamy sand, 0 to 2 percent slopes, in a cultivated field, SW¼SE¼SE¼ sec. 20, T. 5 N., R. 15 E., about 50 feet west of third utility pole west from Baumann Road and 57 feet north of Big Hand Road:

Ap—0 to 8 inches, very dark gray (10YR 3/1) loamy sand; weak, fine, granular structure; very friable; medium acid; abrupt, smooth boundary.

B21hir—8 to 14 inches, dark yellowish-brown (10YR 4/4) loamy sand; few, medium, distinct, strong-brown (7.5YR 5/8) and grayish-brown (10YR 5/2) mottles; weak, fine, subangular blocky structure; very friable; slightly acid; abrupt, wavy boundary.

A&B—14 to 22 inches, A part, pale-brown (10YR 6/3) sand; fine, medium, faint, grayish-brown (10YR 5/2) mottles; single grain; loose; B part, dark-brown (7.5YR 4/4) loamy sand; faint, fine, distinct, grayish-brown (10YR 5/2) mottles; very weak, fine, subangular blocky structure; very friable; occurs as a series of discontinuous lenses 1/4 to 1 inch thick; neutral; abrupt, wavy boundary.

446-054—74——4

B22t—22 to 29 inches, brown (10YR 5/3) light loamy sand; common, medium, distinct, yellowish-brown (10YR 5/8) mottles and common, medium, faint, grayish-brown (10YR 5/2) mottles; very weak, fine, subangular blocky structure; very friable; thin, discontinuous clay films on most surfaces of peds and bridging of sand grains; neutral; clear, smooth boundary.

B23t—29 to 37 inches, dark yellowish-brown (10YR 4/4) sandy loam; common, medium, distinct, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; weak, coarse, subangular blocky srtucture; very friable; thin clay films on most surfaces of peds and bridging of sand grains; neutral; clear, wavy boundary.

B3—37 to 48 inches, dark-brown (10YR 4/3) loamy sand; common; medium, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/8) mottles; very weak, coarse, subangular blocky structure; very friable; some clay bridging of sand grains; mildly alkaline; clear, wavy boundary.

C1—48 to 60 inches, dark-brown (10YR 4/3) sand; common, fine, faint, grayish-brown (10YR 5/2) and pale-brown (10YR 6/3) mottles; single grain; loose; mildly alkaline; abrupt, wavy boundary.

IIC2—60 to 66 inches, light brownish-gray (10YR 6/2) coarse and very coarse sand; single grain; loose; 5 percent coarse fragments; calcareous.

The solum ranges from 42 to 50 inches in thickness. It ranges from very strongly acid to slightly acid throughout the upper part and from medium acid to mildly alkaline throughout the lower part. Wooded areas have a thin A1 horizon that is 2 to 4 inches thick and is black (10YR 2/1) or very dark brown (10YR 2/2). A discontinuous A2 horizon occurs in a few soil profiles. It is grayish brown (10YR 5/2) and 1 or 2 inches thick. The Ap horizon ranges from 7 to 10 inches in thickness and is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). The A horizon is loamy sand or light loamy sand.

The B21hir horizon is dark yellowish brown (10YR 4/4) or dark brown (7.5YR 4/4). Mottles are mainly strong brown (7.5YR 5/6 and 5/8), yellowish brown (10YR 5/4, 5/6, and 5/8), and grayish brown (10YR 5/2). The A part of the A&B horizon is pale-brown (10YR 6/3) or brown (10YR 5/3) sand that is mottled mainly with grayish brown (10YR 5/2), yellowish brown (10YR 5/6 and 5/8), or strong brown (7.5YR 5/6 & 5/8). The B part of the A&B horizon is dark-brown (7.5YR 4/4 or 10YR 4/3) loamy sand, and it has mottles like those in the B2 part.

The first Bt lens or horizon generally is 20 to 36 inches below the surface. The B22t, B23t, and B3 horizons are not present in all areas. In a few soil profiles, they are separated by layers of sand as in the A&B horizon. If these thicker horizons are present, they are brown (10YR 5/3), dark yellowish brown (10YR 4/4), or dark brown (7.5YR 4/4 or 10YR 4/3), and they have mottles of grayish brown (10YR 5/2), yellowish brown (10YR 5/6 and 5/8), strong brown (7.5YR 5/6 and 5/8), and gray (10YR 5/1). Texture is mainly loamy sand, sandy loam, and in a few profiles, light sandy clay loam. The thickness and sequence of these Bt horizons, lenses, or thin layers are variable in short horizontal distances, but dominantly they have a total thickness of 6 inches or more in the upper 40 inches.

The C1 horizon is absent in many profiles. If present, the C1 horizon is dark-brown (10YR 4/3), brown (10YR 5/3), or yellowish-brown (10YR 5/4) sand mottled with grayish brown (10YR 5/2) and pale brown (10YR 6/3). The C1 horizon is mildly alkaline or moderately alkaline (calcareous). The IIC2 horizon, if present, is calcareous, grayish-brown (10YR 5/2 or 2.5Y 5/2) or gray (10YR 5/1), layered sand and very coarse sand that is 5 to 15 percent fine gravel.

Otisco soils are similar to Wasepi, Wainola, and Minoa soils. Otisco soils have a thicker solum and a greater depth to limy materials than the Wasepi soils. The materials in which Otisco soils formed contain coarser sand and slightly more clay than those of the Wainola soils. Otisco soils have a coarser textured solum and underlying materials than have the Minoa soils. The drainage of Otisco soils is similar to that of the Metamora and Avoca soils. Otisco soils have a coarser textured solum than the Metamora soils and lack the underlying loamy materials at a depth of 18 to 40 inches. The Otisco soils formed in materials containing coarser sand and having a slightly higher clay content than the Avoca soils, and they lack the loamy materials that underlie the Avoca soils at a depth of 18 to 40 inches.

Otisco loamy sand, 0 to 2 percent slopes (OaA).—This somewhat poorly drained soil occupies small depressions, narrow drainageways, low domelike mounds, and large, very slightly undulating areas. Areas are long and narrow to wide and irregular, and they range from 2 to about 150 acres in size.

Included with this soil in mapping are small areas of poorly drained to very poorly drained Lamson fine sandy loam, Gilford sandy loam, and Deford fine sand. These included soils occur in slight depressions and narrow drainageways. Also included, around the outer edges of this mapping unit, are narrow strips that are underlain by loamy materials at a depth of 30 to 40 inches.

Wetness and low natural fertility are the main limitations of this soil. Drainage is difficult to establish and maintain because of the sandy materials. Ditchbanks are unstable, and tile lines are commonly filled by sand. This soil has a low available water capacity, and during midsummer when the water table is low, the soil is droughty. This soil is moderately suited to locally adapted crops. Most areas are cleared, some only for pasture, but many scattered woodlots remain that are mostly in second-growth hardwoods. Capability unit IIIw-5 (4b); woodland group 3w2.

Palms Series

The Palms series consists of nearly level, very poorly drained, organic soils that are underlain by silty clay loam at a depth of 16 to 50 inches. These soils formed in well-decomposed organic materials that were derived from herbaceous plant remains. Palms soils occur in depressional areas on lake plains, glacial drainageways, and till plains.

In a typical profile the surface layer is highly decomposed organic material 5 inches thick. The subsurface consists of two layers of highly decomposed organic material that have a combined thickness of 17 inches. The underlying mineral material is gray and dark-gray silty clay loam mottled with olive.

Surface runoff is ponded. Permeability is very rapid in the upper organic part of these soils and moderately slow in the lower mineral part. Available water capacity is very high. These soils are of moderate extent and are of some local importance for truck cropping and sod production. Palms soils have severe limitations for most nonfarm uses.

Typical profile of Palms muck in a cultivated field, center of NW¼SW¼ sec. 21, T. 8 N., R. 13 E.:

Oa1—0 to 5 inches, black (N 2/0) sapric material; less than 5 percent fiber and a trace after rubbing; weak, fine, granular structure; friable; about 3 percent fine sand; neutral; abrupt, smooth boundary.

Oa2—5 to 13 inches, black (5YR 2/1) sapric material; about 5 percent fiber and a trace after rubbing; weak, thick, platy structure; friable; about 3 percent fine sand; neutral; abrupt, smooth boundary.

Oa3—13 to 22 inches, black (5YR 2/1) sapric material; 8 percent fiber and less than 3 percent after rubbing; weak, fine and medium, platy structure; firm; mildly alkaline; abrupt, wavy boundary.

IIC1g—22 to 28 inches, gray (5Y 5/1) silty clay loam; few, medium, distinct, olive (5Y 5/3) mottles; massive; firm; mildly alkaline; abrupt, wavy boundary.

IIC2g—28 to 62 inches, dark-gray (5Y 4/1) silty clay loam; common, medium, distinct, olive (5Y 5/6) mottles; massive; firm; calcareous.

The depth to the loamy mineral materials dominantly is 17 to 45 inches but ranges from 16 to 50 inches. In most soil profiles the organic materials are highly decomposed, though there are some woody fragments ranging from 1/32 inch to 2 inches in diameter. The organic materials were derived from herbaceous plant materials. The surface tier, 0 to 12 inches thick, is black (10YR 2/1, N 2/0, or 5YR 2/1) sapric material. It ranges from medium acid to mildly alkaline. The organic layers below the surface tier are dominantly black (5YR 2/1) sapric material. A few profiles have thin hemic layers just above the underlying mineral materials. Reaction ranges from medium acid to mildly alkaline.

The IICg horizon is mainly gray (10YR 5/1 or 5Y 5/1), dark gray (10YR 4/1 or 5Y 4/1), grayish brown (10YR 5/2 or 2.5Y 5/2), or olive gray (5Y 4/2). Mottles are strong brown (7.5YR 5/6), olive (5Y 4/3, 5/3, and 5/6), or yellowish brown (10YR 5/4, 5/6 and 5/8). The texture is mainly loam, silt loam, clay loam, or silty clay loam. The mineral materials were derived from stratified lacustrine sediments or glacial till. They range from neutral to moderately alkaline (calcareous).

Palms soils are similar to the Houghton soils, but Palms soils formed in shallower organic deposits. Palms soils are underlain by loamy mineral materials at a depth of 16 to 50 inches, and Houghton soils formed in organic deposits that are more than 50 inches deep to mineral materials. Palms soils occur near areas of Bach, Lamson, Thomas, and Tobico soils, and they have thicker, organic surface and subsurface layers that contain more organic matter and less mineral materials than these mineral soils.

Palms muck (0 to 2 percent slopes) (Pa).—This very poorly drained soil occupies large, level areas and small, slightly concave depressions. It is in irregularly shaped areas that range from 2 to 150 acres in size.

Included with this soil in mapping are small, scattered spots of the deep Houghton muck. Also included are the Parkhill, Bach, Thomas, and Lamson mineral soils. These included mineral soils are in small, scattered, islandlike spots and narrow bands around the outside edges of Palms muck. Other inclusions are a few areas that have sandy underlying materials and some 1- to 5-acre areas that have thin layers of marl just above the loamy underlying materials.

Wetness, hazards of frost and soil blowing, low natural fertility, and instability of the organic materials are the chief limitations of this soil. Some drainage is needed for most crops. Tile drainage is difficult to establish because of subsidence and the normal lack of a good outlet. Soil blowing is a hazard on drained and cultivated areas. Where these limitations are reduced, this soil is well suited to vegetables and sod grass. Many areas of this soil are farmed. Capability unit IIw–10 (M/3c); woodland group –w1.

Parkhill Series

The Parkhill series consists of nearly level, poorly drained soils. These soils formed in limy loam or light clay loam glacial till. They occur in broad areas, in small, slightly concave depressions, and in long, narrow drainageways on till plains.

In a typical profile the surface layer is a very dark gray loam 9 inches thick. The subsoil is dark-gray and gray, firm and very firm clay loam to heavy silty clay loam that has many, small streaks and spots of very dark gray, yellowish brown, dark yellowish brown, dark grayish brown, and olive brown. The subsoil is 37 inches thick. The limy underlying material is gray and dark grayish-brown light clay loam and heavy loam. It commonly is spotted and streaked with olive brown, yellowish brown, and dark gray.

Surface runoff is very slow to ponded. Permeability is moderately slow, and available water capacity is high. Most areas of Parkhill soils are cultivated. These soils have a large acreage in the county and are of major importance to farming. Wetness limits many nonfarm uses.

In this county the Parkhill soils were mapped alone, in a complex with Conover soils, and in a complex with Metamora soils.

Typical profile of Parkhill loam in an area of Conover-Parkhill loams, 0 to 2 percent slopes, in an old fence row, SW¼NW¼NW¼ sec. 14, T. 5 N., R. 15 E., 50 feet east from the center of Hessen Road:

Ap—0 to 9 inches, very dark gray (10YR 3/1) loam; moderate, fine, granular structure; friable; 5 percent coarse fragments; mildly alkaline; abrupt, smooth boundary.

B21g—9 to 18 inches, dark-gray (10YR 4/1) clay loam; common, fine, faint, very dark gray (10YR 3/1) mottles and many, fine, distinct, yellowish-brown (10 YR 5/6), and dark-gray (N 4/0) mottles; weak, medium, prismatic structure separating to moderate, fine and medium, angular blocky; firm; 10 percent coarse fragments; neutral; clear, wavy boundary.

B22g—18 to 28 inches, dark-gray (5Y 4/1) clay loam; many, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure separating to moderate, medium and coarse, angular blocky; firm; thin patchy clay films on vertical surfaces of peds; 10 percent coarse fragments; neutral; clear, wavy boundary.

B23g—28 to 46 inches, gray (5Y 5/1) heavy silty clay loam; many, medium, distinct, olive-brown (2.5Y 4/4) and dark grayish-brown (2.5Y 4/2) mottles; weak, medium, prismatic structure separating to moderate, medium and coarse, angular blocky; very firm; thin patchy clay films on vertical surfaces of peds and along cracks; 10 percent coarse fragments; mildly alkaline; abrupt, wavy boundary.

C1g—46 to 56 inches, gray (5Y 5/1) light clay loam; many, fine and medium, distinct and prominent, olive-brown (2.5Y 4/4) and yellowish-brown (10YR 5/6) mottles; very weak, medium, angular blocky structure; firm; 10 percent coarse fragments; calcareous; clear, wavy boundary.

C2g—56 to 71 inches, dark grayish-brown (2.5Y 4/2) heavy loam; common, fine, faint, dark-gray (10YR 4/1) mottles; massive; firm; 10 percent coarse fragments; calcareous.

The solum is dominantly 33 to 46 inches thick but ranges from 20 to 50 inches in thickness. Between depths of 10 and 40 inches, the material averages from 18 to 35 percent clay. The solum ranges from slightly acid to mildly alkaline throughout the upper part and from neutral to mildly alkaline throughout the lower part. Coarse fragments throughout the soil profile are 5 to 10 percent gravel and 2 percent cobblestones.

The Ap ranges from 8 to 10 inches in thickness and is very dark gray (10YR 3/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). It is loam to silt loam.

The B horizon is gray (10YR 5/1 or 5Y 5/1) or dark gray (10YR 4/1 or 5Y 4/1). Mottles are mostly yellowish brown (10YR 5/6), very dark gray (10YR 3/1), dark gray (N 4/0), dark yellowish brown (10YR 4/4), olive brown (2.5Y 4/4), dark grayish brown (10YR 4/2 or 2.5Y 4/2), and grayish brown (10YR 5/2 or 2.5Y 5/2). The B horizon is clay loam and silty clay loam. The prismatic structure is absent in a few profiles, and the angular blocky structure ranges from weak to moderate.

The C horizon is gray (10YR 5/1 or 5Y 5/1) or dark grayish brown (10YR 4/2 or 2.5Y 4/2), and it is mottled with yellowish brown (10YR 5/6), dark gray (10YR 4/1 or 5Y 4/1), grayish brown (10YR 5/2 or 2.5Y 5/2), and olive brown (2.5Y 4/4). Texture ranges from loam to light clay loam.

The Parkhill soils developed in materials similar to those of Conover and Londo soils but have a grayer subsoil and a darker surface layer. Parkhill soils are similar to Lenawee soils in drainage but lack the stratification of those soils. Although similar to the Hoytville and Jeddo soils, Parkhill soils have coarser textured B and C horizons than Hoytville soils and are less acid in the upper part of the subsoil than Jeddo soils.

Parkhill loam (0 to 2 percent slopes) (Pc).—This poorly drained soil is in narrow drainageways, in small, slightly concave depressions, and on broad, depressed flats. The areas range from 2 to 600 acres in size and are long and narrow to wide and irregular.

Included with this soil in mapping, in the south-central and southwestern parts of the county, are small areas of somewhat poorly drained Conover loam. Also included, in the northwestern part of the county, are several small areas of somewhat poorly drained Blount loam. Other inclusions are small, scattered areas that are unde..ain by stratified, sandy and loamy materials at a depth of 45 to 64 inches.

Wetness is the main limitation of Parkhill loam. Where adequately drained, this soil is well suited to most locally adapted crops. Nearly all areas are farmed. Capability unit IIw-4 (2.5c) ; woodland group 3w3.

Paulding Series

The Paulding series consists of nearly level, very poorly drained soils. These soils formed in lacustrine clay. They occur on broad lake plains.

In a typical profile the surface layer is very dark gray clay 10 inches thick. The subsoil is 29 inches thick and is gray, firm clay mottled with strong brown. The limy underlying material is gray clay mottled with dark brown and strong brown.

Surface runoff is very slow to ponded. Permeability is very slow, and the available water capacity is moderate. Wetness and the high clay content make these soils difficult to use for farming. These soils have severe limitations for most nonfarm uses.

Typical profile of Paulding clay in a cultivated field, 110 feet north of Broadridge Road, 1,260 feet west-northwest from the corner of River Road, M-29, and Broadbridge Road, Cottrellville Township:

Ap—0 to 10 inches, very dark gray (10YR 3/1) clay, light gray (10YR 6/1) dry; weak, moderate, subangular blocky structure; firm; neutral; abrupt, wavy boundary.

B21g—10 to 16 inches, gray (5Y 5/1) clay; common, medium, prominent, strong-brown (7.5YR 5/8) mottles; moderate, fine and medium, angular blocky structure; firm; neutral; clear, wavy boundary.

B22g—16 to 30 inches, gray (5Y 5/1) clay; common, medium, prominent, strong-brown (7.5YR 5/8) mottles; moderate, medium, prismatic structure separating to strong, medium, angular blocky; firm; neutral; clear, wavy boundary.

B23g—30 to 39 inches, gray (5Y 5/1) clay; common, medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, medium, prismatic structure breaking to moderate, medium, angular blocky; firm; mildly alkaline; abrupt, wavy boundary.

C1g—39 to 55 inches, gray (5Y 5/1) clay; many, medium, prominent, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/8) mottles; weak, coarse, angular blocky structure; firm; calcareous; clear, wavy boundary.

C2g—55 to 60 inches, gray (5YR 5/1) clay; many, medium, prominent, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/8) mottles; weak, coarse, angular blocky structure grading to massive with depth; firm; calcareous.

The solum is commonly 35 to 39 inches thick. Between depths of 10 and 40 inches, the soil averages between 60 to 80 percent clay and is less than 8 percent fine sand or coarser material. The solum is slightly acid to neutral throughout the upper part and is neutral to mildly alkaline throughout the lower part. The Ap horizon, when moist, is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and, when dry, is light gray (10YR 6/1) and light brownish gray (10YR 6/2). The Ap horizon ranges from 5 to 10 inches in thickness and is clay or silty clay.

The matrix colors of the B horizon are gray (10YR 5/1 or 5Y 5/1) or dark gray (10YR 4/1 or 5Y 4/1), and the mottles are mainly yellowish brown (10YR 5/8), strong brown (7.5YR 5/8), or dark yellowish brown (10YR 4/4).

The C horizon is dominantly light gray (10YR 6/1 and 5Y 6/1) or gray (10YR 5/1 or 5Y 5/1).

Paulding soils occur near Toledo and Latty soils. The material in which Paulding soils formed is more than 60 percent clay, and these soils lack the stratification and coarser textured layers characteristic of the Toledo soils. Paulding soils have a higher content of clay in the uppermost 40 inches than the Latty soils. The drainage of Paulding soils is similar to that of Hoytville soils, but Paulding soils have a higher clay content in the A, B, and C horizons.

Paulding clay (0 to 2 percent slopes) (Pd).—This very poorly drained soil is in areas that range from 10 to about 200 acres in size. These areas generally are longer than they are wide.

Included with this soil in mapping are some small areas of Toledo silty clay loam that has thin layers of fine sandy loam and clay loam in the substratum. Also included, in a few places along the Belle River, are small areas of Paulding clay that is covered with 10 to 20 inches of stratified silt, very fine sandy loam, and silty clay loam. Some small, scattered, caplike mounds consist of sandy loam material that has some gravel and is 7 to 40 inches thick over clay. Other inclusions are some areas of somewhat poorly drained clayey soils that are similar to the Paulding clay. These included areas are on low rises, on broad, domelike mounds, and on short, ridgelike side slopes bordering drainageways. They have slopes that range from 2 to 4 percent.

Wetness, the high clay content, and very slow permeability are the main limitations of this soil. This soil is extremely difficult to drain, and good internal drainage is seldom obtained. Heaving of shallow-rooted plants is a critical problem. The period of optimum workability is short because this soil is slippery and very plastic when wet and becomes very hard and cracks when dry.

This soil is moderately suited to a few adapted crops. The removal of surface water and poor soil tilth are problems in farming. Most areas of this soil are cleared and farmed. Capability unit IIIw-1 (Oc) ; woodland group 4w1.

Pert Series

The Pert series consists of nearly level to gently sloping, somewhat poorly drained soils. These soils formed in limy silty clay loam glacial till. They are 12 to 22 inches deep to limy material. Pert soils occur on undulating till plains and water-laid moraines.

In a typical profile the surface layer is dark grayish-brown loam 7 inches thick. The subsoil is 10 inches thick. It is a dark-brown, firm clay mottled with small spots of grayish brown, gray, and dark grayish brown. The limy underlying material is grayish-brown silty clay loam mottled with small spots of gray, light brownish gray, dark yellowish brown, and dark grayish brown.

Pert soils have medium to slow surface runoff. Permeability is slow, and the available water capacity is high. These soils are important to farming, but artificial drainage is needed for dependable cropping. Wetness limits many nonfarm uses of these soils.

In St. Clair County the Pert soils were mapped alone and also in complex with Sims soils.

Typical profile of Pert loam in an area of Pert-Sims loams, 0 to 6 percent slopes, in a cultivated field, NW¼SW¼SW¼SW¼ sec. 10, T. 7 N., R. 16 E., 100 feet east of large single oak tree that is about 450 feet northeast of Clyde Township Hall:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, granular structure; friable; 10 percent coarse fragments; neutral; abrupt, smooth boundary.

Bt—7 to 17 inches, dark-brown (10YR 4/3) clay; common, fine, faint, grayish-brown (10YR 5/2) and dark grayish-brown (10YR 4/2) mottles and few, fine, distinct, gray (10YR 5/1) mottles; weak, fine, prismatic structure separating to moderate, fine and medium, angular blocky; firm; about 10 percent of the grayish-brown (10YR 5/2) color on the peds is films of silt and very fine sand; all surfaces of peds have thin, continuous clay films; 10 percent coarse fragments; abrupt, wavy boundary.

C1g—17 to 24 inches, grayish-brown (10YR 5/2) silty clay loam; many, fine, faint, dark grayish-brown (10YR 4/2), gray (10YR 5/1), and light brownish-gray (10YR 6/2) mottles and common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; very weak, medium, prismatic structure separating to weak, fine and medium, angular blocky; firm; peds have a few, thin, discontinuous clay films on vertical surfaces; 10 percent coarse fragments; calcareous; gradual, wavy boundary.

C2g—24 to 62 inches, grayish-brown (10YR 5/2) light silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles and common, fine, faint, dark grayish-brown (10YR 4/2) and light brownish-gray (10YR 6/2) mottles; weak, coarse, platy structure grading to massive with depth; firm; few clay films on faces of peds and coatings along vertical cracks and root channels; many light-gray (10YR 7/1) spots and streaks of secondary lime; 10 percent coarse fragments; calcareous.

The solum is commonly 15 to 22 inches thick but ranges from 12 to 22 inches in thickness. It is slightly acid to neutral throughout the upper part and is neutral to mildly alkaline throughout the lower part. Coarse fragments throughout the soil profile range from 7 to 12 percent gravel. A small amount of cobblestones is present in almost all areas.

Forested and undisturbed soils have an A1 horizon 2 to 5 inches thick. The A1 horizon is very dark brown (10YR 2/2) very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2). The Ap horizon ranges from 6 to 9 inches in thickness and is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3). It is mostly loam or silt loam.

In a few profiles where the solum is thicker than 20 inches, the Bt horizon is divided into B21t and B22t horizons. These horizons are dominantly dark brown (10YR 4/3), dark yellowish brown (10YR 4/4), or dark brown (7.5YR 4/4). Mottles are mostly grayish brown (10YR 5/2), gray (10YR 5/1), and dark grayish brown (10YR 4/2), and there are some yellowish-brown (10YR 5/6 and 5/8) mottles. The Bt horizon is clay, heavy clay loam, or heavy silty clay loam. It averages between 35 and 45 percent clay. The weak prismatic structure is absent in a few profiles, and the angular blocky structure ranges to subangular blocky structure in a few horizons.

The C1 horizon is not present in all areas. The C horizon is dominantly grayish brown (10YR 5/2), brown (10YR 5/3), or yellowish brown (10YR 5/4). It is light clay loam or light silty clay loam to clay loam and silty clay loam.

Pert soils are similar to Conover, Londo, and Blount in drainage, but they have a finer textured subsoil and parent materials than those soils. The solum of Pert soils is thinner and more alkaline than that of the Blount soils. Pert soils are similar to Hoytville, Latty, and Sims soils. The clay content of Pert soils is less in the C horizon than that of the Nappanee or the Latty soils. The Pert soils are better drained than the Sims soils and lack the dominantly gray upper part of the subsoil.

Pert loam, 2 to 6 percent slopes (PeB).—This somewhat poorly drained soil occurs on smooth, domelike mounds or broad, convex tops of ridgelike areas between deeply depressed drainageways. Areas range from 4 to about 120 acres in size. Dominant slopes are 3 and 4 percent.

Included with this soil in mapping are some small areas of well drained and moderately well drained Morley loam. Also included in a few areas are small, sandy mounds of well-drained Metea loamy sand. Other inclusions are poorly drained Sims loam in some of the small depressions and narrow drainageways.

Wetness and a moderate erosion hazard are the chief limitations of this soil. Where adequately drained, Pert loam is well suited to most locally adapted crops. Most areas are farmed. This soil has a high natural lime content. Capability unit IIw-3 (1b); woodland group 3w1.

Pert-Sims loams, 0 to 6 percent slopes (PIB).—This soil complex consists of somewhat poorly drained Pert loam and poorly drained Sims loam. These soils occur next to each other in areas too small to be mapped separately. They occupy gently undulating areas. Slopes are short and dominantly 2 to 4 percent. Areas of these soils range from about 10 to 200 acres in size. Pert loam makes up about 55 to 70 percent of the complex and occupies the higher convex mounds, knolls, and rises. It has the profile described as typical for the series. Sims loam makes up 20 to 35 percent of the complex and occupies the lower, small, slightly concave depressions, the narrow drainageways, and the depressed flats. This soil has the profile described as typical for the Sims series.

Included with this complex in mapping are some small spots of narrow, ridgelike side slopes along the drainageways. These slopes are 6 to 8 percent. Also included are small areas of well drained and moderately well drained Morley loam on the tops of knolls, ridges, and steepest slopes of this mapping unit. Other inclusions are small, scattered spots of Metea loamy sand, Boyer loamy sand, and Wasepi sandy loam. These included areas are less than 3 acres in size.

Wetness and a moderate erosion hazard are the major limitations of the soils in this complex. Uniform drainage is difficult to obtain because the surface is undulating. Where drainage is adequate, these soils are well suited to most locally adapted crops. Most areas are farmed. Small, scattered areas are wooded. Capability unit IIw-3 (1b, 1.5c); Pert part in woodland group 3w1, Sims part in woodland group 3w3.

Pinconning Series

The Pinconning series consists of nearly level, very poorly drained soils. These soils formed in 18 to 40 inches of water-laid sand and fine sand over clay. They occur in depressional areas on lake plains and glacial drainageways.

In a typical profile the surface layer is black mucky fine sand 8 inches thick. The subsoil is 19 inches thick and consists of three layers. The uppermost 6-inch layer is dark-gray, very friable fine sand that has many, small, black and grayish-brown mottles. The middle layer is gray, loose fine sand 9 inches thick. The lower layer is 4 inches thick and consists of grayish-brown, loose fine sand mottled with gray, dark gray, and light olive brown. The underlying material is limy, dark-gray clay that has many, small, olive-brown and light olive-gray mottles.

Surface runoff is very slow or ponded. Permeability is rapid in the upper sandy part and very slow in the underlying clayey material. Available water capacity is low in the upper sandy part and moderate in the underlying clayey part. Most areas of these soils are cultivated, but they are of little importance to farming because of very small acreage, low fertility, and wetness. Wetness severely limits many nonfarm uses of these soils.

Typical profile of the Pinconning mucky fine sand in a cultivated field, SW¼SW¼SW¼SE¼ sec. 16, T. 3 N., R. 16 E.:

Ap—0 to 8 inches, black (N 2/0) mucky fine sand; very weak, medium, granular structure; friable; mildly alkaline; clear, smooth boundary.

B21g—8 to 14 inches, dark-gray (10YR 4/1) fine sand; common, medium, distinct, black (10YR 2/1) and grayish-brown (10YR 5/2) mottles; very weak, thick, platy structure; very friable; neutral; abrupt, irregular boundary.

B22g—14 to 23 inches, gray (5Y 5/1) fine sand; single grain; loose; slightly acid; clear, irregular boundary.

B23g—23 to 27 inches, grayish-brown (2.5Y 5/2) fine sand; common, fine and medium, faint, gray (5Y 5/1) and dark-gray (5Y 4/1) mottles and common, fine, distinct, light olive-brown (2.5Y 5/4) mottles; single grain; loose; 5 to 7 percent gravel and 1 percent cobblestones; neutral; abrupt, wavy boundary.

IICg—27 to 62 inches, dark-gray (5Y 4/1) clay; common, medium, prominent, olive-brown (2.5Y 4/4) mottles; massive; very firm; many small spots and thin streaks of light olive-gray (5Y 6/2) secondary lime; calcareous.

The sandy upper part of the soil ranges from 18 to 40 inches in thickness. The solum ranges from slightly acid to mildly alkaline. The Ap horizon is black (10YR 2/1 or N 2/0). It is dominantly fine sand or loamy fine sand and contains 8 to 18 percent of organic matter. The Ap horizon ranges from 8 to 10 inches in thickness. In many soil profiles, more B horizons than in the typical profile are differentiated. The B21g horizon, as described, is present in almost all areas. It has a dark-gray (10YR 4/1 or 5Y 4/1) matrix color and a texture of fine sand or loamy fine sand.

The matrix color of the B22g, B23g, or other B horizons ranges from gray (5Y 5/1 and 10YR 5/1) to olive gray (5Y 5/2) and grayish brown (2.5Y 5/2 and 10YR 5/2). The lower B horizons are sand, fine sand, and loamy fine sand. The lowest layer in the sandy upper part of the profile normally contains from 3 to 10 percent gravel and 1 to 5 percent cobblestones.

The IIC horizon has a clay content of more than 48 percent.

Pinconning soils occur near Deford soils but differ from them by being underlain by clay at a depth of 18 to 40 inches. Pinconning soils formed in material similar to that of the Allendale soils but have a grayer, sandy subsoil than the Allendale soils and a darker surface layer. The subsoil of Pinconning soils is grayer, coarser textured, and less gravelly than that of Wasepi soils, clay subsoil variant. Pinconning soils are similar to the Tobico soils in drainage but are underlain by clay at a depth of 18 to 40 inches and are less alkaline in the upper part of the soil profile than the deep, sandy Tobico soils.

Pinconning mucky fine sand (0 to 2 percent slopes) (Pn).—This soil occupies depressed flats and level areas. These areas range from about 5 to 40 acres in size. In a few areas the texture of the entire sandy upper part of this soil is loamy sand. In a few areas the soil beneath the surface layer is limy.

Included with this soil in mapping are small areas of Deford fine sand that amount to 20 to 30 percent of the mapping unit in a few areas. The Deford fine sand is sandy material to a depth of 62 inches or more. Also included are many small spots that have an organic surface layer 10 to 15 inches thick. Other inclusions are a few small areas of a poorly drained loamy sand soil that has a gravelly sandy loam layer underlain by clay at a depth of 18 to 40 inches.

The main limitations of this soil are wetness and low natural fertility. Adequate drainage is needed before most crops can be grown, but it is difficult to establish. When wet, the fine sand tends to flow and fill up the tile lines or ditches. This soil is moderately suited to locally adapted crops. Most areas are not farmed but are idle or brush covered. Capability unit IIIw–8 (4/1c); woodland group 4w1.

Rough Broken Land

Rough broken land (Ro) occupies the steep and very steep bluffs and deep, narrow, gullylike areas bordering the flood plain of the Black River. Slopes range from 18 to 80 percent but are dominantly between 25 and 65 percent. They range from 25 to 300 feet in length. From the top to the bottom of the slopes, differences in elevation range from about 10 to 150 feet. Slopes are less than 18 percent in some small areas along the upland rim, at the heads of draws, on tops of islandlike knobs, and on the narrow sides of terraces. Areas of this unit range from 5 to 500 acres in size.

The soil materials range from clay loam to sand, but loam and clay loam till materials are dominant in most areas. Sandy soils occupy the upper parts of Rough broken land where this land is bordered by large areas of sandy soils. Other sandy areas occur midway or lower on the sides of slopes as small, narrow bench terraces. In many places the soil materials are exposed in raw clifflike banks that have almost vertical slopes.

Areas of Rough broken land have springs and, on the sides of hills, seep spots. Erosion is a severe hazard, and soil creep and landslides are common. The soil materials in this mapping unit are not suited to cultivated crops, but some areas produce fair pasture. Most areas of this unit are wooded or brush covered. Capability unit VIIe–2 (Sa); woodland group not assigned.

Rousseau Series

The Rousseau series consists of nearly level to sloping, well-drained soils. These soils formed in stratified sand and fine sand. They occur on glacial lake beaches, on low dunes of lake plains, and in glacial drainageways.

In a typical profile the surface layer is very dark grayish-brown fine sand 5 inches thick. The upper part of the subsoil is dark-brown, very friable fine sand 14 inches thick. The lower part is strong-brown, loose fine sand 11 inches thick. The underlying material is pale-brown and brown, stratified fine sand and sand.

Surface runoff is slow. Permeability is rapid, and available water capacity is low. These soils are not important to farming. They have few limitations for most nonfarm uses.

Typical profile of Rousseau fine sand, 0 to 6 percent slopes, in an abandoned crop field, SW¼SE¼SW¼ sec. 29, T. 7 N., R. 16 E., about 150 feet north of Rynn Road and 50 feet west of large white oak tree.

Ap—0 to 5 inches, very dark grayish brown (10YR 3/2) fine sand; very weak, fine, subangular blocky structure; very friable; strongly acid; abrupt, smooth boundary.

B21hir—5 to 19 inches, dark-brown (7.5YR 4/4) fine sand; very weak, medium, subangular blocky structure; very friable; strongly acid; clear, wavy boundary.

B22ir—19 to 30 inches, strong-brown (7.5YR 5/6) fine sand; single grain; loose; medium acid; abrupt, wavy boundary.

C1—30 to 44 inches, pale-brown (10YR 6/3) fine sand; single grain; loose; medium acid; clear, wavy boundary.

C2—44 to 64 inches, brown (10YR 5/3), stratified sand and fine sand; common, fine, faint, pale-brown (10YR 6/3) and yellowish-brown (10YR 5/4) mottles; single grain; loose; lowest 10 inches of horizon contains two 1- to 3-inch layers of coarse sand; medium acid.

The solum ranges from 30 to 40 inches in thickness. It is very strongly acid to medium acid. The depth to calcareous materials ranges from 42 inches to more than 66 inches. Forested areas have a black (5YR 2/1 or 10YR 2/1) fine sand A1 horizon about 4 inches thick. Uncultivated areas have an A2 horizon that is dark gray (10YR 4/1), grayish brown (10YR 5/2), or light brownish gray (10YR 6/2). It is fine sand 2 to 4 inches thick. The Ap horizon ranges from 5 to 9 inches in thickness and is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). The B21hir horizon is dark brown (7.5YR 4/4 or 10YR 4/3), reddish brown (5YR 4/3 or 4/4), or dark reddish brown (5YR 3/3 or 3/4). It ranges from 1 to 12 inches in thickness and is fine sand. The B22ir horizon is brown (7.5YR 5/4), strong brown (7.5YR 5/6), or yellowish brown (10YR 5/4, 10YR 5/6). The texture is fine sand. A few profiles have mottles starting 30 to 44 inches from the soil surface. The underlying C horizon is brown (10YR 5/3), grayish brown (10YR 5/2), pale brown (10YR 6/3), light brown (7.5YR 6/4), or light brownish gray (10YR 6/2). It is mainly fine sand that has a few sand or coarse sand layers 1 to 3 inches thick.

Rousseau soils are similar to Eastport, Croswell, Spinks, and Chelsea soils. Rousseau developed in sand that is finer textured than that of Eastport or Croswell soils. Lacking in the Rousseau soils are the loamy sand lenses, bands, and layers common in the Spinks and Chelsea soils. Rousseau soils occur near Wainola soils but are better drained than Wainola soils and lack mottles in the upper part of the subsoil. Rousseau soils are similar to Metea soils in drainage but lack the loamy layer in the lower part of the subsoil and the loamy underlying materials that occur at a depth of 18 to 40 inches.

Rousseau fine sand, 0 to 6 percent slopes (RuB).—This well-drained soil occupies level to gently sloping and undulating areas. These areas range from 2 to about 160 acres in size and from long, narrow, and winding to irregular. Slopes are short and dominantly 1 to 4 percent. The soil profile is that described as typical for the series.

Included with this soil in mapping are a few areas of very poorly drained Deford fine sand and somewhat poorly drained Wainola loamy fine sand in small depressions and narrow drainageways. Also included are many, small, moderately eroded spots.

Low natural fertility, low available water capacity, and a moderate erosion hazard are the main limitations of this soil. The soil is subject to erosion by both water and wind. This soil is moderately suited to some locally adapted crops. Most areas are farmed. Capability unit IIIs–4 (4a); woodland group 3s1.

Rousseau fine sand, 6 to 12 percent slopes (RuC).—This well-drained soil occupies areas of ridges and knolls. These areas are long, narrow, convex, and winding ridges and oval or round domelike knolls. They range from 2 to about 30 acres in size.

Included with this soil in mapping are level areas on the top of the knolls and ridges. Also included are many moderately eroded and a few severely eroded spots and small areas that have short, moderately steep slopes.

A moderately severe erosion hazard, low natural fertility, and droughtiness are the main limitations of this soil. This soil is moderately suited to locally adapted crops. Most of it is forested or brush covered, and only a few areas have been cleared. This soil has been used as a source of sand, and many, small, scattered open pits and borrow pits occur. Capability unit IIIe–9 (4a); woodland group 3s1.

Sanilac Series

The Sanilac series consists of nearly level, somewhat poorly drained soils. These soils formed in limy, water-laid sediment of very fine sandy loam and loamy very fine sand. They occur on the slightly higher areas of the lake plains.

In a typical profile the surface layer is very dark grayish brown, mildly alkaline very fine sandy loam 8 inches thick. The subsoil is 30 inches thick and consists of four layers. The first layer is dark-brown very friable very fine sandy loam that has many scattered spots of grayish brown, brown, and dark grayish brown. It is 4 inches thick and is limy. The second layer is yellowish-brown, very friable loamy very fine sand that has spots of grayish brown and dark brown. It is limy and 3 inches thick. The third layer is light brownish-gray, very friable light silt loam spotted with olive brown. It is limy and 2 inches thick. The fourth layer is grayish-brown, very friable very fine sandy loam that has many, small spots of olive brown and yellowish brown. It is limy and 21 inches thick. The limy underlying material is grayish-brown and gray, stratified very fine sandy loam and loamy very fine sand that has many small spots of olive brown, yellowish brown, dark yellowish brown, and light brownish gray.

Surface runoff is slow, and permeability is moderate. Available water capacity is moderate. These soils are not important to farming in the county. They are commonly used as recreational areas, such as those for summer cottages, water sports, and waterfowl. Wetness limits many of the other nonfarm uses.

Typical profile of Sanilac very fine sandy loam, 0 to 2 percent slopes, in an idle cultivated field on Harsen's Island, T. 2 N., R. 16 E., about 460 feet east from Ferry Landing Road along North Channel Road Highway (M–154), 360 feet south of North Channel Road, and 25 feet west of old fence row:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) very fine sandy loam; very weak, fine, subangular blocky structure; very friable; mildly alkaline; abrupt, smooth boundary.

B21—8 to 12 inches, dark-brown (10YR 4/3) very fine sandy loam; many, fine, faint, dark grayish-brown (10YR 4/2), grayish-brown (10YR 5/2), and brown (10YR

5/3) mottles; very weak, medium, platy structure; very friable; calcareous; abrupt, wavy boundary.

B22—12 to 15 inches, yellowish-brown (10YR 5/4) loamy very fine sand; many, fine, distinct, yellowish-brown (10YR 5/6), grayish-brown (10YR 5/2), and dark-brown (10YR 4/3) mottles; very weak, medium, platy structure; very friable; calcareous; abrupt, wavy boundary.

B23g—15 to 17 inches, light brownish-gray (2.5Y 6/2) light silt loam; common, fine, distinct, light olive-brown (2.5Y 5/4) mottles; weak, thin, platy structure; very friable; calcareous; abrupt boundary.

B24g—17 to 38 inches, grayish-brown (2.5Y 5/2) very fine sandy loam; many, fine, distinct, light olive-brown (2.5Y 5/4) and yellowish-brown (10YR 5/6) mottles; very weak, medium, platy structure; very friable; calcareous; abrupt, wavy boundary.

C1g—38 to 50 inches, grayish-brown (2.5Y 5/2), stratified very fine sandy loam and loamy very fine sand; many, fine, distinct, yellowish-brown (10YR 4/6), dark yellowish-brown (10YR 4/4), light olive-brown (2.5Y 5/4), and light brownish-gray (2.5Y 6/2) mottles; massive; very friable; 1- to 5-inch, discontinuous layers alternate in texture and have abrupt boundaries; calcareous; abrupt, wavy boundary.

C2g—50 to 64 inches, light-gray (5Y 6/1) very fine sandy loam; many, fine, prominent, yellowish-brown (10YR 5/6) and light olive-brown (2.5Y 5/4) mottles; massive; very friable; calcareous.

Sanilac soils are calcareous at or near the surface. Between depths of 10 and 40 inches, the soil material is less than 18 percent clay and the content of very fine sand and silt together ranges from 40 to 80 percent. In forested or undisturbed areas, the profile has a black (10YR 2/1) very fine sandy loam A1 horizon 3 to 6 inches thick. The Ap horizon is very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). It is very fine sandy loam, loamy very fine sand, or silt loam. Reaction is neutral to mildly alkaline (calcareous).

The B21 and B22 horizons are dominantly dark brown (10YR 4/3), brown (10YR 5/3), dark grayish brown (10YR 4/2), and yellowish brown (10YR 5/4). Mottles are mainly grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) in combination with the dominant colors. The B23g and B24g horizons are dominantly light brownish gray (2.5Y 6/2 or 10YR 6/2), grayish brown (2.5Y 5/2 or 10YR 5/2), or gray (10YR 5/1 or 5Y 5/1). Mottles are light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6). The B horizon is mainly very fine sandy loam, loamy very fine sand, silt loam, and very fine sand. The C horizon is dominantly grayish brown (2.5Y 5/2), gray (10YR 5/1 or 5Y 5/1), light gray (10YR 6/1 or 5Y 6/1), or light brownish gray (10YR 6/2 or 2.5Y 6/2). Mottles are mainly yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), light olive brown (2.5Y 5/4), and light brownish gray (2.5Y 6/2). The C horizon has approximately the same texture as the B horizon, but a few soil profiles have thin layers of fine sand, fine sandy loam, silt, sand, and fine gravel in the lower part.

Sanilac soils are similar to Londo, Conover, Blount, and Minoa soils in drainage. Sanilac soils are shallower to free carbonates and more stratified than the Londo, Conover, and Blount soils, which were derived from till. The subsoil of Sanilac soils is more alkaline than that of Minoa soils. The Sanilac soils developed in material similar to that of the Bach soil but are better drained and have less gray in the upper part of the subsoil. Sanilac soils are similar to the Wainola, Otisco, and Wasepi soils in drainage but have finer textured underlying materials and are shallower to free lime than these soils.

Sanilac very fine sandy loam, 0 to 2 percent slopes (SaA).—This somewhat poorly drained soil occupies areas that range from about 3 to 500 acres in size and have irregular shapes.

Included with this soil in mapping are a few 1- to 5-acre areas of a soil that contains fine gravel in the uppermost 40 inches. Also included are many areas of very poorly drained Bach very fine sandy loam in small, slight depressions and narrow drainageways. Other inclusions are along boat canals and river channels, and these consist of small areas of fill 1 to 5 feet thick. This material was dug or dredged out of the canals or channels.

Wetness, the high lime content, and the high content of very fine sandy loam and silt loam are the main limitations of this soil. Drainage is difficult to establish and maintain. When wet, the very fine sandy loam and silt loam tend to flow and to make the sloughing of ditchbanks and the plugging of tile lines constant problems. Where drainage is adequate, this soil is well suited to most locally adapted crops. Many areas are not used for farming, because they are isolated on islands in Lake St. Clair and are close to seasonally flooded areas. Many of these areas are inaccessible to farm machinery and can be reached only by boat. Areas on Harsens Island can be farmed. The woodland is in second-growth hardwoods. Capability unit IIw-6 (2.5b-c); woodland group 3w2.

Sims Series

The Sims series consists of nearly level, poorly drained soils. These soils formed in limy silty clay loam glacial till. They occur on water-laid moraines and till plains.

In a typical profile the surface layer is very dark grayish-brown loam 9 inches thick. The upper part of the subsoil is 10 inches thick and consists of dark-gray, firm silty clay loam that is mottled with dark yellowish brown, dark brown, gray, and yellowish brown. The lower part of the subsoil is 11 inches thick and consists of dark-gray, firm light clay mottled with gray, dark yellowish brown, and yellowish brown. The limy underlying material starts at a depth of 30 inches. Its uppermost layer is 11 inches thick and is grayish-brown silty clay loam mottled with dark gray and yellowish brown. This layer is over yellowish-brown silty clay loam mottled with gray, light brownish gray, and light gray.

Surface runoff is very slow to ponded. Permeability is slow, and available water capacity is high. These soils are important to farming. Wetness limits many nonfarm uses of these soils.

Typical profile of Sims loam in an area of Pert-Sims loams, 0 to 6 percent slopes, in a cultivated field, NE¼NW¼SW¼SW¼ sec. 10, T. 7 N., R. 16 E., about 340 feet east of single large white oak tree, about 450 feet northeast of the Clyde Township Hall.

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, granular structure; friable; slightly acid; abrupt, smooth boundary.

B21g—9 to 19 inches, dark-gray (10YR 4/1) silty clay loam; many, medium, distinct, dark yellowish-brown (10YR 4/4), dark brown (10YR 4/3), and yellowish-brown (10YR 5/6) mottles and a few, medium, faint, gray (10YR 5/1) mottles; very weak, medium, prismatic structure separating to moderate, fine, angular blocky; firm; thin discontinuous clay films on only the prismatic faces of peds; neutral; clear, wavy boundary.

B22g—19 to 30 inches, dark-gray (10YR 4/1) light clay; few, medium, faint, gray (10YR 5/1) mottles and many, medium, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure separating to moderate, medium, angular blocky; firm; thin clay films on most prismatic surfaces of peds and a few blocky surfaces of peds; mildly alkaline; abrupt, wavy boundary.

C1g—30 to 41 inches, grayish-brown (10YR 5/2) silty clay loam; many, fine, distinct, yellowish-brown (10YR 5/6) and dark-gray (10YR 4/1) mottles; weak, medium, platy structure separating to weak, fine, angular blocky; friable; calcareous; gradual, wavy boundary.

C2—41 to 62 inches, yellowish-brown (10YR 5/4) silty clay loam; many, fine, distinct, gray (10YR 5/1), light brownish-gray (10YR 6/2), and yellowish-brown (10YR 5/6) mottles; massive; friable; many, light-gray (10YR 6/1 and 7/1) streaks and spots of secondary lime; calcareous.

The solum is dominantly 22 to 30 inches thick but ranges from 20 to 40 inches in thickness. Between depths of 10 to 40 inches, the soil averages between 35 and 45 percent clay. Wooded areas have a black (10YR 2/1) or very dark brown (10YR 2/2) loam A1 horizon 3 to 5 inches thick. The Ap horizon ranges from 8 to 10 inches in thickness and is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or very dark brown (10YR 2/2). It is loam, heavy loam, or silt loam and ranges from medium acid to neutral.

The dominant color of the B21g horizon is dark gray (10YR 4/1 or N 4/0), gray (10YR 5/1 or 5Y 5/1), or light gray (10YR 6/1), and mottles are mainly dark yellowish brown (10YR 4/4), dark brown (10YR 4/3), dark grayish brown (10YR 4/2), gray (10YR 5/1), and yellowish brown (10YR 5/6 and 5/8). The main colors of the B22g horizon are dark gray (10YR 4/1), grayish brown (10YR 5/2), and gray (10YR 5/1). Mottles are mostly dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6 and 5/8), gray (10YR 5/1), and dark gray (10YR 4/1). The B horizon is mainly clay loam, silty clay loam, and light clay. It is slightly acid to neutral in the B21g horizon and is neutral to mildly alkaline in the B22g horizon. The prismatic structure is absent in many soil profiles.

The C horizon is mainly grayish brown (10YR 5/2 or 2.5Y 5/2) or dark grayish brown (10YR 4/2) that grades to brown (10YR 5/3) or yellowish brown (10YR 5/4) with depth. The main mottles are strong brown (7.5YR 5/6), dark brown (7.5YR 4/4 or 10YR 4/3), gray (10YR 51), light gray (10YR 6/1 and 7/1), yellowish brown (10YR 5/6 and 5/8), light brownish gray (10YR 6/2), and dark gray (10YR 4/1). The C horizon is clay loam or silty clay loam.

Sims soils are similar to Parkhill, Hoytville, and Jeddo soils. Sims soils have a finer textured subsoil and underlying materials than the Parkhill soils. The subsoil and underlying materials of Sims soils are coarser textured than those of the Hoytville soils. The Sims soils have a darker plow layer and a more alkaline subsoil than the Jeddo soils, and less accumulations of clay films and flows of fine clay in the subsoil.

Sims loam (0 to 2 percent slopes) (Sm).—This poorly drained soil occupies level to slightly concave depressions, narrow drainageways, and depressed flats. Most areas of Sims loam are long and narrow, and they are along the drainageways. In places the narrow strips widen into large irregular areas. This soil also occurs in small, scattered, round or oval depressions. These areas range from 2 to about 40 acres in size.

Included with this soil in mapping are small, narrow strips of somewhat poorly drained Pert loam and Blount loam that occur on the outer edges of this mapping unit. Also included are small spots that are limy at the surface.

Wetness is the main limitation of Sims loam. Where adequate drainage is established, the soil is well suited to most locally adapted crops. Many areas have been cleared and cultivated, but a few are still forested. The wooded areas are mostly in second-growth hardwoods. Capability unit IIw-2 (1.5c); woodland group 3w3.

Spinks Series

The Spinks series consists of nearly level to gently sloping, well-drained soils. These soils formed in sandy and gravelly glacial drift. They occur on low glacial lake beaches, in glacial drainageways, and on outwash plains.

In a typical profile the surface layer is very dark grayish-brown loamy sand 9 inches thick. The subsoil consists of four layers that combined are 57 inches thick. The uppermost layer is brown, very friable light loamy sand 11 inches thick. The next layer also is 11 inches thick and is dark yellowish-brown, loose sand. The lower two layers consist of thin, discontinuous lenses and layers of dark yellowish-brown and dark-brown, very friable loamy sand that alternate with slightly thicker layers of brown, loose sand. The limy underlying materials are stratified, brown and grayish-brown sand and gravel.

Surface runoff is slow. Permeability is rapid, and the available water capacity is low. Spinks soils are not important to farming. They have few limitations for most nonfarm uses.

Typical profile of Spinks loamy sand, 2 to 6 percent slopes, in the bank of a borrow pit, SW¼SW¼NW¼ sec. 18, T. 4 N., R. 15 E.:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loamy sand; weak, fine, subangular blocky structure; very friable; 7 to 10 percent gravel; strongly acid; abrupt, smooth boundary.

B1—9 to 20 inches, brown (7.5YR 5/4) light loamy sand; very weak, medium, subangular blocky structure; very friable; 10 to 12 percent gravel; medium acid; clear, wavy boundary.

B21—20 to 31 inches, dark yellowish-brown (10YR 4/4) sand; single grain; loose; 6 percent gravel; medium acid; abrupt, wavy boundary.

A&B—31 to 45 inches, A part, brown (10YR 5/3) sand; single grain; loose; B part, dark yellowish-brown (10YR 4/4) loamy sand; very weak, fine, subangular blocky structure; very friable; occurs as a series of discontinuous lenses 1/16 to 1 inch thick; medium acid; abrupt, wavy boundary.

B&A—45 to 66 inches, B part, dark-brown (7.5YR 4/4) loamy sand; very weak, fine, subangular blocky structure; very friable; occurs as discontinuous lenses ¼ to 3 inches thick; A part, brown (10YR 5/3) sand; single grain; loose; occurs as layers ½ inch to 4 inches thick; medium acid; abrupt, wavy boundary.

C—66 to 75 inches, brown (10YR 5/3) and grayish-brown (10YR 5/2), stratified sand and gravel; single grain; loose, calcareous.

Thickness of the solum and depth to calcareous materials range from 42 inches to more than 66 inches. The solum ranges from strongly acid to slightly acid throughout the upper part and from medium acid to neutral throughout the lower part. The Ap horizon ranges from 6 to 10 inches in thickness and is very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and dark brown (10YR 4/3 and 3/3). It is loamy sand. An A2 horizon is in a few soil profiles and is yellowish brown (10YR 5/4) or brown (10YR 5/3). It is sand, fine sand, or light loamy sand.

The B1 horizon is absent in a few profiles but, if it is present, it is brown (7.5YR 5/4) or yellowish brown (10YR 5/4). It is light loamy sand, sand, and fine sand. The B2 horizon is absent in many profiles. In the A&B and B&A horizons, the A horizons are brown (10YR 5/3) or pale-brown (10YR 6/3) sand or fine sand ½ to 4 inches thick. The B horizons are dark yellowish-brown (10YR 4/4) or dark-brown (7.5YR 4/4 or 10YR 4/3) loamy sand, sandy loam, or heavy sandy loam, The B horizons are discontinuous and 1/16 to 3 inches thick. The A and B horizons are alternating lenses or layers, and the B horizons have an accumulative thickness of more than 6 inches within the upper 40 inches.

The C horizon is absent in a few profiles. If present, the C horizon is layered, grayish-brown (10YR 5/2), brown (10YR 5/3), or yellowish-brown (10YR 5/4) sand, gravel, or a mixture of sand and gravel. Reaction is neutral or mildly alkaline (calcareous).

Spinks soils are similar to Chelsea, Croswell, Rousseau, and Eastport soils. Spinks soils have finer textured lenses, bands, and layers in the upper 40 inches than the Chelsea soils. The lenses, bands, and layers in the subsoil and underlying materials of Spinks soils are finer textured than those of the Croswell, Rousseau, and Eastport soils. Spinks soils are similar to Boyer soils in drainage but have a thicker, less compact, and slightly coarser textured subsoil, a lower gravel content, and a greater depth to limy materials.

Spinks loamy sand, 0 to 2 percent slopes (SpA).—This well-drained soil occupies gently sloping, long, low ridges, moundlike hills, and undulating plains. These areas range from 4 to about 40 acres in size and generally are longer than they are wide.

Included with this soil in mapping are areas that are underlain by loamy and clayey till or lacustrine materials at a depth of 45 to 60 inches. Also included are small, scattered spots of Metea loamy sand that are underlain by loamy material at a depth of 18 to 40 inches.

The chief limitations of this soil are the low natural fertility and droughtiness. This soil is moderately suited to general farming. Where cultivated, this soil is subject to soil blowing. Only a few areas are still forested with hardwoods, and a few areas are planted to pines. Some areas are used for Christmas trees. Capability unit IIIs-3 (4a); woodland group 3s1.

Spinks loamy sand, 2 to 6 percent slopes (SpB).—This well-drained soil occupies gently sloping, long, low ridges, knolls, and gently undulating areas. The slopes are short and dominantly about 4 percent. Generally, the small areas are convex, or domelike, and the larger undulating areas have convex and concave slopes. The areas range from 2 to about 100 acres in size. The soil profile is that described as typical for the series.

Included with this soil in mapping are small spots of Metea loamy sand that is underlain by loamy material at a depth of 18 to 40 inches. Also included are a few areas that are underlain by loamy or clayey till or lacustrine materials at a depth of 45 to 60 inches. Other inclusions are small, nearly level areas on tops of knolls and ridges and a few areas that have small, moderately eroded spots and short, strong slopes along the main drainageways.

The low natural fertility, moderate erosion hazard, and droughtiness of this soil are the main limitations. This soil is moderately suited to general farming. It is subject to erosion by both water and wind. Most areas of this soil are farmed. Capability unit IIIs-4 (4a); woodland group 3s1.

Spinks loamy sand, loamy substratum, 0 to 6 percent slopes (SsB).—This well-drained soil is nearly level to sloping and occurs on domelike mounds, low ridges, and gently undulating areas. Slopes are short and dominantly range from 2 to 4 percent. The areas are mainly convex and generally longer than they are wide. They range from 2 to 30 acres in size. The soil profile is similar to that described for the Spinks series, except that loamy soil material occurs at a depth of 42 to 66 inches.

Included with this soil in mapping are small areas of Spinks soils without the loamy substratum. These included areas occupy the highest points of the knolls or crests of ridges. Also included, around the outer edges of some areas, are narrow strips of somewhat poorly drained Allendale loamy fine sand. Other inclusions in most places are areas of moderately well drained soils that are similar to Spinks soils.

Droughtiness, low natural fertility, and a moderate erosion hazard are the chief limitations of this soil. Most areas have been cleared and cultivated, but many are now idle or used for pasture. This soil is moderately suited to general farming. It is subject to erosion by water and wind. Capability unit IIIs-4 (4a); woodland group 3s1.

Thomas Series

The Thomas series consists of nearly level, very poorly drained soils. These soils formed in limy, lacustrine sediments of silt loam, silty clay loam, silty clay, and clay loam. Thomas soils occur on lake plains and in glacial drainageways.

In a typical profile the surface layer is black mucky silt loam 9 inches thick. The subsoil is 22 inches thick and consists of two layers of limy, dark-gray, very firm and firm silty clay loam that has small, scattered, dark grayish-brown and olive spots. The underlying material is limy, stratified, dark grayish-brown and grayish-brown silty clay loam, silty clay, clay loam, and silt loam. The layers in the underlying material range from 2 to 14 inches in thickness.

Surface runoff is very slow or ponded. Permeability is moderately slow, and available water capacity is high. These soils are of small extent in the county and are of little importance to farming. Wetness severely limits many nonfarm uses of these soils.

Typical profile of a Thomas soil having a mucky silt loam surface layer, in an area of Thomas complex in a cultivated field, NE¼NE¼ sec. 10, T. 3 N., R. 16 E., about 195 feet north of drainage ditch along Chartier Road and 200 feet west of oil well service road:

Ap—0 to 9 inches, black (N 2/0) mucky silt loam; weak, fine and medium, granular structure; friable; slightly acid; abrupt, smooth boundary.

B21g—9 to 13 inches, dark-gray (5Y 4/1) heavy silty clay loam; few, fine, faint, dark grayish-brown (2.5Y 4/2) and olive (5Y 4/3) mottles; weak, medium, prismatic structure breaking to very weak, thick, platy structure; very firm; calcareous; abrupt, wavy boundary.

B22g—13 to 31 inches, dark-gray (5Y 4/1) silty clay loam; many, fine and medium, distinct, dark grayish-brown (2.5Y 4/2) and olive (5Y 4/3) mottles; very weak, medium and thick, platy structure; firm; calcareous; clear, wavy boundary.

IIC1g—31 to 35 inches, dark grayish-brown (2.5Y 4/2) silty clay; many, fine and medium, distinct, dark-gray (5Y 4/1) and dark-brown (10YR 4/3) mottles; massive; firm; calcareous; abrupt, wavy boundary.

IIIC2g—35 to 37 inches, grayish-brown (10YR 5/2) clay loam; common, fine, faint, dark grayish-brown (10YR 4/2) mottles and common, fine, distinct, yellowish brown (10YR 5/6) mottles; massive; firm; 10 to 15 percent fine gravel; calcareous; abrupt, wavy boundary.

IVC3g—37 to 42 inches, grayish-brown (10YR 5/2) silty clay; many, fine, distinct, olive-brown (2.5Y 4/4) mottles; massive; firm; calcareous; abrupt, wavy boundary.

VC4g—42 to 56 inches, dark grayish-brown (2.5Y 4/2) heavy silt loam; common, fine, distinct, olive-brown (2.5Y 4/4) and dark-brown (10YR 4/3) mottles; massive; very friable; calcareous; clear, wavy boundary.

VIC5g—56 to 62 inches, dark grayish-brown (2.5Y 4/2) silty clay loam; common, fine, distinct, very dark gray (5Y 3/1), dark-gray (5Y 4/1), and yellowish-brown (10YR 5/6) mottles; massive; firm; calcareous.

Depth to the calcareous materials ranges from 0 to 10 inches. Between depths of 10 to 40 inches, the soil averages between 33 and 35 percent clay. In a few profiles, there is a black

(5Y 2/1) organic layer less than 1 foot thick. The Ap horizon is dominantly 9 inches thick and consists of black (N 2/0 or 10YR 2/1) mucky silt loam. It ranges from slightly acid to mildly alkaline (calcareous). The Bg horizons are absent in a few profiles. If they are present, their main colors are gray (10YR 5/1 or 5Y 5/1), dark gray (10YR 4/1 or 5Y 4/1), or olive gray (5Y 4/2), and mottles are dark grayish brown (10YR 4/2 and 2.5Y 4/2), olive (5Y 4/3), olive brown (2.5Y 4/4), strong brown (7.5Y 5/6), or yellowish brown (10YR 5/6). The B horizon is silt loam, loam, silty clay loam, clay loam, clay, and silty clay. The structure of the B horizon is weak, and the strongest development is in the uppermost part.

The C horizon is mainly dark grayish brown (2.5Y 4/2), grayish brown (10YR 5/2 or 2.5Y 5/2), olive gray (5Y 5/2 and 4/2), or dark gray (10YR 4/1 or 5Y 4/1). Mottles are olive brown (2.5Y 4/4), dark grayish brown (10YR 4/2 or 2.5Y 4/2), olive (5Y 4/3 and 4/4), dark brown (10YR 4/3), yellowish brown (10YR 5/6), very dark gray (5Y 3/1), dark gray (10YR 4/1 and 5Y 4/1), and gray (10YR 5/1 and 5Y 5/1). The C horizon has the same texture as the B horizons and, in addition, has layers of fine sandy loam, very fine sandy loam, silt, and a few thin sandy layers. Some layers are from 2 to 15 percent of gravel.

Thomas soils occur near the Lenawee and Toledo soils. Thomas soils are shallower to free lime than the Lenawee soils and have darker material that is more organic in the surface layer. They developed in loamy materials that have a lower clay content than the materials in which the Toledo soils developed. Also, Thomas soils have a darker surface than Toledo soils and a more alkaline subsoil. Thomas soils are similar to the Bach and Lamson soils, but Thomas soils developed in finer textured material than did the Bach soils and are finer textured and shallower to limy materials than the Lamson soils.

Thomas complex (0 to 2 percent slopes) (Th).—This complex consists of very poorly drained Thomas mucky silt loam and a limy, very poorly drained, stratified, clayey soil similar to the Thomas soil. These soils occur next to each other in areas too small and too closely associated to be mapped separately. They are in broad, slightly depressed, nearly level areas that range from 5 to 160 acres in size. Thomas mucky silt loam makes up about 50 to 60 percent of the complex, and the stratified, clayey soil makes up about 30 to 40 percent. These soils occupy similar positions, and the differences between them are their profiles. Although similar to the Thomas soil, the clayey soil formed in dominantly clay and silty clay materials. Both soils are calcareous at or near the surface.

Included with this complex in mapping are small areas of Palms muck and spots of soil that have a well-decomposed, organic surface layer 10 to 15 inches thick. Also included are many small spots of Bach very fine sandy loam that amount to about 10 percent of most areas. Bach very fine sandy loam consists mainly of very fine sandy loam and loamy fine sand. In some places small included areas have limy, loamy glacial till materials exposed at the surface or at a depth of 20 to 40 inches.

Wetness and the limy root zone are the main limitations. Uniform drainage is difficult to obtain, and complete tile drainage systems are difficult to install. In spring and during the extremely wet periods, the soils in this complex are subject to ponding by surface runoff from the surrounding uplands. Capability unit IIw-2 (1.5c-c); woodland group 4w1.

Tobico Series

The Tobico series consists of nearly level, very poorly drained soils. These soils formed in limy, water-laid fine sand and sand. They occur in slightly depressed areas on glacial lake beaches and lake plains.

In a typical profile the surface layer is black mucky fine sand 7 inches thick. The limy underlying material consists of dark-gray, light brownish-gray, grayish-brown, and gray layers of fine sand and sand that extend to a depth of more than 60 inches.

Surface runoff is very slow or ponded. Permeability is rapid, and available water capacity is very low.

These soils are not important to farming. They are commonly used for recreational purposes. Wetness severely limits most nonfarm uses of these soils.

In St. Clair County the Tobico soils were mapped only in a complex with Wainola soils.

Typical profile of a Tobico soil having a mucky fine sand surface layer, in an area of Wainola-Tobico complex, 0 to 3 percent slopes, in a cutover, idle area in brush, NW¼SW¼NW¼NW¼ sec. 4, T. 7 N., R. 17 E., in first, low, troughlike depression west of Montevista Road and directly opposite of its intersection with Roosevelt Road:

Ap—0 to 7 inches, black (10YR 2/1) mucky fine sand; weak, medium, granular structure; very friable; mildly alkaline; abrupt, smooth boundary.

C1g—7 to 12 inches, dark-gray (10YR 4/1) fine sand; common, medium, distinct, grayish-brown (10YR 5/2) and dark-gray (N 4/0) mottles; single grain; loose; calcareous; abrupt, irregular boundary.

C2—12 to 20 inches, light brownish-gray (10YR 6/2) fine sand; common, medium, faint, grayish-brown (10YR 5/2) and brown (10YR 5/2) mottles and common, medium, distinct, yellowish-brown (10YR 5/6) mottles; single grain; loose; calcareous; clear, wavy boundary.

C3—20 to 35 inches, grayish-brown (10YR 5/2) sand; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; single grain; loose; calcareous; abrupt, wavy boundary.

C4g—35 to 60 inches, gray (10YR 5/1), stratified sand and fine sand; single grain; loose; includes a few layers of sand or fine sand that are 1 to 4 inches thick and contain 3 to 15 percent of gravel; calcareous.

Depth to calcareous materials ranges from 0 to 15 inches. In undisturbed areas, some profiles have a surface mat of organic materials less than 1 foot thick. This organic layer is black and partly decomposed to well decomposed. It is neutral to mildly alkaline (calcareous). Disturbed areas have an Ap horizon of mixed mineral and organic materials that are black (10YR 2/1 or 5Y 2/1) and mildly alkaline (calcareous). The Ap horizon is fine sand or mucky fine sand.

The C1g horizon has a dominant color of dark gray (10YR 4/1 or 5Y 4/1), gray (10YR 5/1 or 5Y 5/1), or grayish brown (10YR 5/2 or 2.5Y 5/2). Mottles, if present in the C1g horizon, are few to common, medium, and faint to distinct and are most commonly grayish brown (10YR 5/2 or 2.5Y 5/2), dark gray (N 4/0), and yellowish brown (10YR 5/6). The C2 and C3 horizons are dominantly light brownish gray (10YR 6/2), grayish brown (10YR 5/2 or 2.5Y 5/2), or gray (10YR 5/1 or 5Y 5/1), and the main mottles are grayish brown (10YR 5/2), yellowish brown (10YR 5/6 and 5/4), and brown (10YR 5/3). The C4g horizon is mainly gray (10YR 5/1 or 5Y 5/1) or light gray (10YR 6/1, 7/1 or 5Y 6/1, 7/1), and it is not mottled. The C horizon is sand or fine sand, and in a few profiles, a few thin layers contain 3 to 25 percent of gravel.

Tobico soils are similar to Bach and Deford soils. Tobico soils are coarser textured and less stratified with contrasting materials than Bach soils. Free lime is at a shallower depth in the Tobico soils than in the Deford soils. Tobico soils occur near Gilford and Wainola soils. The Tobico soils are shallower to free lime than Gilford soils and lack the finer textured subsoil. They are shallower to free lime and have a higher water table than the Wainola soils. Tobico soils are similar to Pinconning soils but lack the fine-textured materials at a depth of 18 to 40 inches.

Toledo Series

The Toledo series consists of nearly level, very poorly drained soils. These soils formed in lacustrine sediments of limy silty clay that has layers of clay loam and fine sandy loam. They occur in level to slightly depressed areas on lake plains and glacial drainageways.

In a typical profile the surface layer is very dark gray silty clay loam 9 inches thick. The subsoil is 32 inches thick and consists of four layers. The upper two layers are dark-gray, firm clay and silty clay that have small spots of dark yellowish brown and yellowish brown. The thickness of these layers combined is 10 inches. The lower two layers of the subsoil are gray, firm light clay, and they have many small spots of yellowish brown and dark yellowish brown. The thickness of these layers combined is 22 inches. The limy underlying material is stratified, grayish-brown clay loam that has spots of yellowish brown, gray, and light olive brown; olive-brown fine sandy loam that has spots of grayish brown, gray, and dark brown; and gray silty clay that has spots of yellowish brown and olive brown.

Surface runoff is very slow to ponded. Permeability is slow, and available water capacity is high. Farming is limited by wetness and poor workability. Wetness, slow permeability, and the clayey texture of these soils severely limit many nonfarm uses.

In this county the Toledo soils were mapped alone and in a soil complex with Allendale and Lenawee soils.

Typical profile of Toledo silty clay loam in an area of Allendale-Lenawee-Toledo complex, 0 to 3 percent slopes, in a cultivated field, NW¼SW¼NW¼SW¼ sec. 10, T. 4 N., R. 16 E., about 150 feet east of Wadhams Road:

Ap—0 to 9 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, granular structure; very friable; neutral; abrupt, smooth boundary.

B21g—9 to 13 inches, dark-gray (5Y 4/1) clay; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, fine and medium, angular blocky structure; firm; neutral; clear, wavy boundary.

B22g—13 to 19 inches, dark-gray (5Y 4/1) silty clay; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; very weak, medium, prismatic structure separating to moderate, fine and medium, angular blocky; firm; thin, patchy clay coatings on the prismatic surfaces of peds; neutral; clear, wavy boundary.

B23g—19 to 32 inches, gray (5Y 5/1) light clay; many, medium, prominent, yellowish-brown (10YR 5/6) mottles; very weak, medium, prismatic structure separating to weak, medium, angular blocky; firm; thin, discontinuous clay coatings on all prismatic faces of peds and about 60 percent on the angular blocky faces of peds; neutral; clear, wavy boundary.

B24g—32 to 41 inches, gray (5Y 5/1) light clay; many, medium, prominent, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) mottles; very weak, medium, angular blocky structure; firm; mildly alkaline; abrupt, wavy boundary.

IIC1—41 to 49 inches, grayish-brown (10YR 5/2) clay loam; many, medium, distinct, yellowish-brown (10YR 5/6), gray (10YR 5/1), and light olive-brown (2.5Y 5/4) mottles; massive; friable; calcareous; abrupt, wavy boundary.

IIIC2—49 to 52 inches, olive-brown (2.5Y 4/4) fine sandy loam; many, fine, distinct, grayish-brown (10YR 5/2), gray (10YR 5/1), and dark-brown (10YR 4/3) mottles; massive; friable; calcareous; abrupt, wavy boundary.

IVC3g—52 to 64 inches, gray (5Y 5/1) silty clay; many, fine, prominent, gray (N 5/0), yellowish-brown (10YR 5/8), and olive-brown (2.5Y 4/4) mottles; massive; very firm; calcareous.

The solum is dominantly 27 to 45 inches thick but ranges from 24 to 55 inches in thickness. Between depths of 10 and 40 inches, the soil averages between 42 and 50 percent clay. The Ap horizon ranges from 6 to 10 inches in thickness and is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). It is silt loam or silty clay loam and medium acid to neutral.

Dominant colors of the B horizon are gray (10YR 5/1 or 5Y 5/1) or dark gray (10YR 4/1 or 5Y 4/1). The mottles are dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/4, 5/6, and 5/8), grayish brown (10YR 5/2 or 2.5Y 5/2), and strong brown (7.5YR 5/6 and 5/8). The B horizon is clay, silty clay, silty clay loam, and clay loam. It is slightly acid or neutral throughout the upper part and neutral or mildly alkaline throughout the lower part.

The C horizon is grayish brown (10YR 5/2 or 2.5Y 5/2), gray (10YR 5/1 or 5Y 5/1), olive brown (2.5Y 4/4), dark grayish brown (2.5Y 4/2), dark gray (10YR 4/1 or 5Y 4/1), or light brownish gray (10YR 6/2 or 2.5Y 6/2). It is mottled with gray (10YR 5/1), olive brown (2.5Y 4/4), gray (N 5/0), yellowish brown (10YR 5/4, 5/6 and 5/8), dark yellowish brown (10YR 4/4), light olive brown (2.5Y 5/4), light gray (10YR 6/1 or 5Y 6/1), grayish brown (10YR 5/2 or 2.5Y 5/2), dark brown (10YR 4/3), or strong brown (7.5YR 5/6 and 5/8). The C horizon is clay, silty clay, silty clay loam, clay loam, a few silt loam and fine sandy loam layers, and a few, thin, sandy lenses. The average clay content of the C horizon is more variable than the uppermost 40 inches of the profile and ranges from 35 to 50 percent.

Toledo soils occur near Lenawee, Latty, Paulding, and Thomas soils. Toledo soils have a finer textured subsoil and underlying materials than the Lenawee soils. They have more contrasting stratification with loamy strata than the Latty and Paulding soils and a lower average clay content in the uppermost 40 inches. The Toledo soils have a lighter colored surface layer than the Thomas soils and a thicker, finer textured, less alkaline subsoil. They are similar to the Hoytville soils in drainage and in the average clay content of the uppermost 40 inches, but Toledo soils formed in lacustrine sediments and have more stratification with loamy material than the till-derived Hoytville soils. Toledo soils are similar to Jeddo soils in drainage. They formed in clayey, stratified lacustrine materials, but the Jeddo soils formed in loamy till and are more uniform in texture.

Toledo silty clay loam (0 to 2 percent slopes) (To).—This very poorly drained soil occupies level to nearly level areas and depressed flats. The areas range from about 5 to 100 acres in size.

Included with this soil in mapping are small areas of Toledo soils that have a clay, clay loam, or mucky silty clay loam plow layer. In some places scattered fine gravel is on the surface. Also included are small areas of Lamson fine sandy loam that consist mainly of loamy and sandy sediments.

Wetness, the high clay content, and the slow permeability of this soil are the chief limitations. This soil is slow to warm up and dry out in the spring. Adequate drainage is difficult to obtain in some areas. Ponded surface water and poor soil tilth are management concerns. This soil is moderately suited to most locally adapted crops. Capability unit IIIw-1 (1c); woodland group 3w3.

Wainola Series

The Wainola series consists of nearly level, somewhat poorly drained soils. These soils formed in water-laid, limy fine sands. They occur on glacial lake beaches, outwash plains, and deltas.

In a typical profile the surface layer is very dark grayish-brown fine sand 9 inches thick. The subsoil consists of three layers. The upper layer is dark-brown, very friable fine sand that has strong-brown mottles and is 7 inches thick. The lower two layers are yellowish-brown, loose fine sand that has mottles of dark yellowish brown, strong brown, dark brown, pale brown, and grayish brown. These two layers combined are 21 inches thick. The limy underlying materials are gray and grayish-brown fine sand mottled with light olive brown and olive brown.

Surface runoff is slow. Permeability is rapid, and the available water capacity is low. Farming is limited by wetness and low fertility. Wetness of these soils limits many nonfarm uses.

In this county the Wainola soils were mapped alone and also in a complex with the Deford soils and in a complex with the Tobico soils.

Typical profile of Wainola fine sand in an area of Wainola-Deford fine sands, 0 to 2 percent slopes, in a cultivated field, NW¼SW¼SW¼ sec. 20, T. 7 N., R. 17 E., about 200 feet east of State Road and 200 feet south of old east-west fence line:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) fine sand; very weak, fine, subangular blocky structure; very friable; medium acid; abrupt, smooth boundary.

B21hir—9 to 16 inches, dark-brown (7.5YR 4/4) fine sand; many, fine, faint, strong-brown (7.5YR 5/6) mottles; very weak, medium and coarse, subangular blocky structure; very friable; medium acid; abrupt, wavy boundary.

B22ir—16 to 25 inches, yellowish-brown (10YR 5/4) fine sand; many, fine and medium, distinct, strong-brown (7.5YR 5/6) and dark-brown (7.5YR 4/4) mottles; single grain; loose; medium acid; clear, wavy boundary.

B23—25 to 37 inches, yellowish-brown (10YR 5/6) fine sand; common, fine and medium, faint, dark yellowish-brown (10YR 4/4) mottles and common, fine and medium, distinct, grayish-brown (10YR 2/2) and pale-brown (10YR 6/3) mottles; single grain; loose; slightly acid; abrupt, wavy boundary.

C1—37 to 49 inches, grayish-brown (2.5Y 5/2) fine sand; many, fine, distinct, light olive-brown (2.5Y 5/4), olive-brown (2.5Y 4/4), and gray (5Y 5/1) mottles; single grain; loose; calcareous, gradual, wavy boundary.

C2g—49 to 62 inches, gray (5Y 5/1) fine sand; single grain; loose; calcareous.

The solum ranges from 18 to 40 inches in thickness. Depth to calcareous materials is commonly 34 to 45 inches, but this depth ranges from 28 inches to more than 62 inches in short horizontal distances.

A few forested areas have A1 and A2 horizons. The A1 horizon is black (10YR 2/1) and is 3 to 6 inches thick. The A2 horizon is light brownish gray (10YR 6/2), grayish brown (10YR 5/2), or pinkish gray (7.5YR 6/2) and is 2 to 5 inches thick. The Ap horizon is very dark grayish brown (10YR 3/2) or very dark brown (10YR 2/2) and ranges from 6 to 9 inches in thickness. The A horizon is fine sand or loamy fine sand. It is strongly acid to slightly acid.

The B21hir horizon ranges from 3 to 14 inches in thickness and has dominant colors of dark brown (10YR 4/3 or 7.5Y 4/4), dark yellowish brown (10YR 4/4), or reddish brown (5YR 4/4). It is mottled mainly with yellowish brown (10YR 5/6 and 5/8), strong brown (7.5YR 5/6 and 5/8), and dark reddish brown (5YR 3/2, 3/3, and 3/4). The B21hir horizon is fine sand, loamy sand, or loamy fine sand. It ranges from strongly acid to slightly acid. The B22ir horizon and other B horizons are mostly strong brown (7.5YR 5/6), yellowish brown (10YR 5/4 or 5/6), or brown (10YR 5/3 or 7.5YR 5/4) and have mottles of dark brown (10YR 4/3 or 7.5YR 4/4), strong brown (7.5YR 5/6 and 5/8), pale brown (10YR 6/3), dark yellowish brown (10YR 4/4), and grayish brown (10YR 5/2). They are medium acid to slightly acid.

The C horizon is grayish brown (10YR 5/2 or 2.5Y 5/2), light brownish gray (10YR 6/2), or gray (5Y 5/1 or 10YR 5/1) where it is calcareous. It is strong brown (7.5YR 5/6), yellowish brown (10YR 5/4 or 5/6), brown (10YR 5/3 or 7.5YR 5/4), or pale brown (10YR 6/3) where it is not calcareous. The C horizon is fine sand, loamy fine sand that has thin layers of sand, coarse sand, and very fine sand. It ranges from slightly acid to mildly alkaline (calcareous).

The Wainola soils formed in materials similar to those of the Deford soils, but they are better drained and have less gray in the upper part of the subsoil. Wainola soils are similar to the Avoca and Minoa soils. They developed in deep sands and, unlike the Avoca soils, lack the underlying finer textured materials at a depth of 18 to 40 inches. They have a coarser textured subsoil and underlying material than Minoa soils. Wainola soils occur with the Chelsea, Croswell, Eastport, and Rousseau soils but, unlike them, are mottled in the upper part of the subsoil. Wainola soils are similar to the Sanilac and Wasepi soils in drainage. They formed in coarser textured materials than the Sanilac soils and have a more acid subsoil. Wainola soils formed mainly in fine sand and lack the finer textured subsoil and coarser textured sand and gravel of the Wasepi soils.

Wainola loamy fine sand, 0 to 2 percent slopes (WaA).—This somewhat poorly drained soil occurs as slightly convex, irregularly shaped mounds or low rises. Areas range from 5 to 15 acres in size. The soil profile is similar to that described for the series, except that the plow layer is loamy fine sand and the subsoil contains a few layers of very fine sand and loamy very fine sand in some areas.

Included with this soil in mapping are a few areas of very poorly drained Deford fine sand in small depressions.

Wetness, the naturally low fertility, and the fine sand and very fine sand are the main limitations of this soil. This soil is difficult to drain because of the fine and very fine sandy materials. Because these sandy soils tend to flow when they are wet, ditchbanks slough and tile lines are plugged. Drained areas of this soil are droughty in midsummer. This soil is moderately suited to locally adapted crops. Small areas of this soil are farmed. Capability unit IIIw–5 (4b); woodland group 3w2.

Wainola-Deford fine sands, 0 to 2 percent slopes (WdA).—This complex consists of somewhat poorly drained Wainola fine sand and very poorly drained Deford fine sand. These soils occur next to each other in areas too small to be mapped separately. They are level to nearly level and very gently undulating. These areas range from about 5 to 300 acres in size. Wainola fine sand makes up about 45 to 70 percent of the mapping unit and occupies the higher, slightly convex, mounds, knolls, and low rises. Deford fine sand makes up about 15 to 40 percent of the areas and occupies the lower, slightly concave depressions, narrow drainageways, and depressed flats.

Included with these soils in mapping are many, small, scattered, domelike mounds of well-drained Rousseau fine sand that has 3 and 4 percent slopes. These included areas make up as much as 15 percent of some areas. Also included are a few, small, low spots of poorly drained Gilford sandy loam.

Wetness and the low natural fertility are the chief limitations of these soils. The uneven surface and the fine sand make these soils difficult to drain. Because these sandy soils tend to flow when they are wet, ditchbanks slough and tile lines are plugged. The low, very poorly drained Deford fine sand is slow to dry out and warm up in spring, and the higher, somewhat poorly drained Wainola fine sand is droughty in midsummer. Under cultivation when the weather is dry, the higher parts of Wainola fine sand are slightly to moderately susceptible to soil blowing. These soils are moderately suited to locally adapted crops. Small areas of this complex are farmed. Capability unit IIIw–5 (4b, 4c); Wainola part in woodland group 3w2, Deford part in woodland group 4w1.

Wainola-Tobico complex, 0 to 3 percent slopes (WnA).—This complex consists of somewhat poorly drained Wainola fine sand and very poorly drained Tobico mucky fine sand. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. They are level to gently sloping and undulating. These soils are in areas that range from 10 to 400 acres in size. They occur in a 1- to 2-mile-wide strip that borders the shoreline of Lake Huron in the northeastern part of the county. The Wainola soil makes up about 50 to 60 percent of the complex and occupies the higher, long, narrow mounds, knolls, and low ridges. The Tobico soil makes up about 30 to 40 percent of the areas and occupies the troughlike swales, slightly concave depressions, and depressed flats. The somewhat poorly drained mounds and low ridges range from 50 to 400 feet in width, 100 to 1,500 feet in length, and 2 to 3 percent in slope. These mounds have a general north-south orientation and occur as a series of alternating rows of intermittent low ridges and mounds that have troughlike swales between them. The swales and depressed flats are very poorly drained, are about 50 to 150 feet wide, and have even to slightly concave slopes of 0 to 2 percent.

Included with these soils in mapping are many, small, scattered areas of well-drained Eastport sand that has slopes of 2 to 6 percent. Also included are small areas that have a layer of well-decomposed organic material on top of very poorly drained mineral soils. In some places these soils are underlain with stratified fine peat and silt or loam glacial till at a depth of 30 to 50 inches. In a few spots in areas of Tobico mucky fine sand, thin layers of limy silt or marl occur just below the mucky surface layer.

The main limitations of this complex are the uneven surface, low natural fertility, and wetness. Most areas are covered with thick stands of aspen, white birch, elm, and tag alder. Open spots have a cover of wetland brush, sedges, weeds, and grass. Very few areas have been cultivated; several areas are pastured. Capability unit IIIw–5 (4b, 5c–c); Wainola part in woodland group 3w2, Tobico part in woodland group 4w1.

Wasepi Series

The Wasepi series consists of nearly level to gently sloping, somewhat poorly drained soils. These soils formed in 24 to 42 inches of loamy sand and sandy loam materials over stratified sand and gravel. They occur in glacial drainageways, on outwash plains, and on low glacial lake beaches.

In a typical profile the surface layer is very dark grayish-brown sandy loam 9 inches thick. The subsoil is 20 inches thick and consists of three layers. The upper layer is 5 inches thick and is dark-brown, friable light sandy loam that is mottled with grayish brown, dark grayish brown, and yellowish brown. The middle layer is 4 inches thick and consists of grayish-brown, friable light sandy loam mottled with dark grayish brown and yellowish brown. The lower layer is 11 inches thick and is dark grayish-brown, very friable loamy sand mottled with dark gray and brown. The upper part of the underlying material is grayish-brown, stratified gravelly sand and sand. It is 9 inches thick. The lower part, below a depth of 38 inches, is limy, brown gravelly sand.

Surface runoff is slow. Permeability is moderately rapid, and available moisture capacity is low. These soils are of small extent but locally are important to farming. Wetness limits many nonfarm uses.

In St. Clair County the Wasepi soils were mapped alone and also in a complex with Boyer soils. In this complex, Wasepi soils are underlain by loamy material at a depth of 42 to 66 inches.

Typical profile of Wasepi sandy loam, 0 to 2 percent slopes, in a cultivated field, NW¼NW¼ sec. 12, T. 7 N., R. 15 E., about 100 feet south of road fence opposite shagbark hickory tree on south side of highway M–136 and 45 feet west of third telephone pole east from Fargo Road:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) sandy loam; very weak, medium, granular structure; very friable; strongly acid; abrupt, smooth boundary.

B21t—9 to 14 inches, dark-brown (10YR 4/3) light sandy loam; common, fine, faint, grayish-brown (10YR 5/2) and dark grayish-brown (10YR 4/2) mottles and common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; strongly acid; clear, wavy boundary.

B22tg—14 to 18 inches, grayish-brown (10YR 5/2) light sandy loam; common, fine, faint, brown (10YR 5/3) and dark grayish-brown (10YR 4/2) mottles and common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; thin clay films on surfaces of peds and bridging between sand grains; strongly acid; clear, wavy boundary.

B3g—18 to 29 inches, dark grayish-brown (10YR 4/2) loamy sand; many, fine, faint, dark-gray (10YR 4/1) and brown (10YR 5/3) mottles; very weak, fine, subangular blocky structure; very friable; 7 to 12 percent gravel; medium acid; abrupt, wavy boundary.

IIC1—29 to 38 inches, grayish-brown (10YR 5/2), stratified gravelly sand and sand; many, medium, faint, dark-brown (10YR 4/3) and dark-gray (10YR 4/1) mottles and common, medium, distinct, yellowish-brown (10YR 5/6) mottles; single grain; loose; 10 percent coarse fragments; slightly acid; abrupt, irregular boundary.

IIC2—38 to 62 inches, brown (10YR 5/3) gravelly sand; few, medium, faint, dark-brown (10YR 4/3) and grayish-brown (10YR 5/2) mottles; single grain; loose; 20 percent coarse fragments; calcareous.

Free carbonates are at a depth ranging from 24 to 42 inches, but this depth dominantly is 32 to 36 inches. Coarse fragments throughout the soil ranges from 0 to 20 percent gravel, but the solum averages from 3 to 10 percent gravel and 1 to 2 percent cobblestones. The Ap horizon is very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), or very dark gray (10YR 3/1). It is heavy loamy sand or sandy loam and ranges from strongly acid to neutral. In a few soil profiles, an A2 horizon is present. The A2 horizon is grayish brown (10YR 5/2), brown (10YR 5/3), or yellowish brown (10YR 5/6). It is sand, loamy sand, or sandy loam.

The B21t horizon, or the B21 horizon in a few profiles, is dark brown (10YR 4/3 or 7.5YR 4/4), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4) mottled with grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), and yellowish brown (10YR 5/6 and 5/8). Texture is loamy sand or sandy loam, and reaction ranges from strongly acid to neutral. The B22t horizon is grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), dark brown (10YR 4/3 or 7.5Y 4/4), or dark yellowish brown (10YR 4/4). It is mottled with grayish brown (10YR 5/2), dark grayish brown (10YR 4/2), brown (10YR 5/3), and yellowish brown (10YR 5/6 and 5/8). The B22t horizon is light sandy loam, heavy sandy loam, or light sandy clay loam. It is strongly acid to mildly alkaline. In a few profiles, the B3 horizon is absent. If present, the B3 horizon is mainly dark grayish brown (10YR 4/2) mottled with grayish brown (10YR 5/2), dark gray (10YR 4/1), and brown (10YR 5/3). The B3 horizon is loamy sand or sand.

The C horizon is dominantly grayish brown (10YR 5/2), gray (10YR 5/1 or 5Y 5/1), light brownish gray (10YR 6/2), brown (10YR 5/3), or yellowish brown (10YR 5/4). Mottles are dark brown (10YR 4/3), light gray (10YR 6/1), dark gray (10YR 4/1 or 4Y 4/1), and yellowish brown (10YR 5/6 and 5/8) and grayish brown (10YR 5/2). The C horizon is sand, coarse sand, gravelly sand, gravel, or sand that is mixed with 2 to 20 percent of gravel. The upper part of the C horizon ranges from slightly acid to mildly alkaline (calcareous). The C horizon typically is calcareous below a depth of 36 inches.

Between the surface layer (A1 or Ap horizon) and a depth of 30 inches, these soils are grayer than the defined range for the series, but this difference does not alter their usefulness and behavior.

Wasepi soils are similar to Otisco and Wainola soils. Wasepi soils have a finer textured, more compact subsoil than the Otisco and Wainola soils. The Wasepi soils formed in materials similar to those of the Gilford soils but are better drained and less gray in the upper part of the subsoil. Normal Wasepi soils lack the loamy underlying material at a depth of 42 to 66 inches that occurs in the Wasepi soils in Wasepi-Boyer complex, loamy substratum.

Wasepi sandy loam, 0 to 2 percent slopes (WoA).—This somewhat poorly drained soil occupies low ridges and moundlike areas. It occurs in areas that are 2 to 50 acres in size and are long and narrow to wide and irregular. The soil profile is that described as typical for the series.

Included with this soil in mapping are small spots of Gilford sandy loam in depressions and drainageways. Also included, in a few places, is Boyer loamy sand on small knolls and short ridgelike side slopes bordering drainageways. Other inclusions are small areas of Metamora sandy loam and Corunna sandy loam that are underlain by loamy till materials.

Wetness and low natural fertility are the main limitations of this soil. Drainage is difficult to establish because of the sandy materials. When wet, this soil tends to flow and to make the sloughing of ditchbanks and plugging of tile lines constant problems. Where adequately drained, this soil is moderately suited to most locally adapted crops. It is droughty in midsummer when the water table is low. Wooded areas are mostly in second-growth hardwoods. Capability unit IIIw–5 (4b); woodland group 3w2.

Wasepi-Boyer complex, loamy substratum, 0 to 6 percent slopes (WpB).—This complex consists of somewhat poorly drained Wasepi sandy loam and well-drained Boyer loamy sand that are both underlain by loamy materials at a depth of 42 to 66 inches. These soils occur next to each other in areas too small and intricately intermingled to be mapped separately. They are nearly level to gently undulating and occupy low, old beach ridges. These areas normally are longer than they are wide and range from 3 to about 200 acres in size. Wasepi sandy loam makes up about 60 to 70 percent of the complex. It is nearly level and very gently sloping and occupies the lower parts of slopes. Boyer sandy loam makes up from 30 to 40 percent of the complex and occupies the higher convex mounds, knolls, and low ridges. The slopes of Wasepi sandy loam are 1 to 3 percent, and those of Boyer loamy sand are 4 to 6 percent. The profiles of these soils are similar to those described for each series, except that loamy material occurs at a depth of 42 to 66 inches.

Included with these soils in mapping, in a few areas of Boyer loamy sand, are small, moderately eroded spots. Also included in areas of Boyer loamy sand are many small areas of similar soils that are moderately well drained. Small areas are included where Wasepi sandy loam and Boyer sandy loam are underlain by the loamy materials at a depth of 30 to 40 inches. Other inclusions are of Gilford sandy loam in narrow drainageways or small depressions.

The fluctuating water table and the low natural fertility are the main limitations of this complex. The long, narrow shapes and the irregular surface of these areas make the soils difficult to drain and troublesome to farm with modern machinery. The soils are droughty in midsummer, and the wet spots delay planting in the spring. These soils are moderately suited to most locally adapted crops. Wooded areas have been severely cut over or have second-growth stands of hardwoods. Capability unit IIIw–5 (4a, 4b); Wasepi part in woodland group 3w2, Boyer part in woodland group 3s1.

Wasepi Series, Clay Subsoil Variant

The Wasepi series, clay subsoil variant, consists of nearly level, somewhat poorly drained soils. These soils formed in 18 to 40 inches of sandy loam, gravelly loamy sand, and sandy material over clay. They occur on glacial lake beaches.

In a typical profile the surface layer is very dark brown sandy loam 8 inches thick. It contains 12 to 20 percent gravel. The subsoil is 19 inches thick and consists of four dark-brown layers that have many small spots and patches of very dark gray, dark gray, gray, dark grayish brown, and grayish brown. The three upper layers of the subsoil are friable and very friable sandy loam that contains 10 to 20 percent gravel. The lower layer is very friable gravelly loamy sand. At a depth of 27 inches is limy, dark-brown gravelly sand. It is mottled with yellowish brown and grayish brown and is 11 inches thick. This layer is underlain by very dark grayish-brown heavy clay at a depth of 38 inches. The clay material extends to a depth of more than 62 inches.

Surface runoff is slow. Permeability is moderately rapid in the sandy upper part of these soils and is very slow in the lower clay part. Available water capacity is moderate. These soils are locally important to farming. Wetness limits may nonfarm uses of these soils.

Typical profile of Wasepi sandy loam, clay subsoil variant, 0 to 3 percent slopes, in an idle grass area in the SE¼ sec. 7, T. 4 N., R. 17 E., 70 feet west of road ditch and 40 feet north of a line opposite a water hydrant on the east side of Highway M–29, about one-quarter mile north of Puttygut Road on Highway M–29.

Ap—0 to 8 inches, very dark brown (10YR 2/2) sandy loam; weak, medium, granular structure; very friable; 12 to 20 percent gravel; medium acid; abrupt, smooth boundary.

B21—8 to 11 inches, dark-brown (7.5YR 4/4) light sandy loam; many, fine, faint, dark-brown (7.5YR 4/2) and dark-gray (10YR 4/1) mottles; weak, very fine and fine, subangular blocky structure; friable; 12 to 20 percent gravel; slightly acid; clear, wavy boundary.

B22tg—11 to 17 inches, dark-brown (7.5YR 4/2) sandy loam; many, fine, distinct, very dark gray (10YR 3/1) and dark-brown (7.5YR 4/4) mottles; weak, fine and medium, subangular blocky structure; friable; thin clay films on most surfaces of peds and films and clay bridges on and between sand grains; 10 to 15 percent gravel; mildly alkaline; clear, irregular boundary.

B23t—17 to 22 inches, dark-brown (10YR 4/3) light sandy loam; many, fine, distinct, very dark gray (10YR 3/1) and dark gray (10YR 4/1) mottles and common, fine, faint, dark grayish-brown (10YR 4/2) mottles; weak, fine, subangular blocky structure; very friable; few, thin, patchy clay films on faces of peds and bridges between sand grains; 15 to 20 percent gravel; mildly alkaline; abrupt, wavy boundary.

B3—22 to 27 inches, dark-brown (10YR 4/3) gravelly loamy sand; many, fine, distinct, dark-gray (10YR 4/1), very dark gray (10YR 3/1), and grayish-brown (10YR 5/2) mottles; very weak, very fine and fine, subangular blocky structure; very friable; 20 percent gravel; calcareous; abrupt, wavy boundary.

IIC1—27 to 38 inches, dark-brown (10YR 4/3) gravelly sand; many, fine, distinct, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; single grain; loose; 20 percent gravel; calcareous; abrupt, wavy boundary.

IIIC2—38 to 62 inches, dark grayish-brown (10YR 4/2) heavy clay; many, medium, distinct, olive-brown (2.5Y 4/4) and gray (N 5/0) mottles; massive; very firm; streaks and spots of gray (N 5/0) and light gray (10YR 7/1, 7/2) secondary lime; calcareous.

Thickness of the sandy upper part of the profile ranges from 18 to 40 inches, and it is extremely variable in short horizontal distances. In the sandy upper part, the gravel content of the individual horizons is variable and ranges from about 5 to 30 percent. The Ap horizon ranges from 6 to 9 inches in thickness and is very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), and dark brown (10YR 3/3). It is sandy loam or gravelly sandy loam and is medium acid to slightly acid.

The B horizon is mainly dark brown (10YR 4/3, 7.5YR 4/4, or 4/2) and dark yellowish brown (10YR 4/4). Mottles are dark brown (7.5YR 4/2 or 4/4), gray (10YR 5/1, N 5/0), dark gray (10YR 4/1, N 4/0), very dark gray (10YR 3/1, N 3/0), yellowish brown (10YR 5/6), grayish brown (10YR 5/2), and dark grayish brown (10YR 4/2). The B22t and B23t horizons are light sandy loam, sandy loam, or heavy sandy loam. The B horizon ranges from slightly acid to neutral throughout the upper part and from slightly acid to mildly alkaline throughout the lower part. The B21, B3, or IIC1 horizon is absent in a few profiles.

The IIIC2 horizon is dominantly dark grayish brown (10YR 4/2) or dark brown (10YR 4/3), calcareous clay that has an average clay content of more than 50 percent.

Wasepi soils, clay subsoil variant, are similar to Allendale, normal Wasepi, Metamora, and Pinconning soils. Wasepi soils, clay subsoil variant, have a finer textured, more alkaline, more gravelly subsoil than the Allendale soils. Unlike normal Wasepi soils, Wasepi soils, clay subsoil variant, are underlain with clay instead of stratified sand and gravel at a depth of 18 to 40 inches. They are underlain with finer textured materials than the Metamora soils at a depth of 18 to 40 inches. Wasepi soils, clay subsoil variant, are less gray, are finer textured, and contain more gravel in the upper parts of the soil profile than the Pinconning soils.

Wasepi sandy loam, clay subsoil variant, 0 to 3 percent slopes (WsA).—This somewhat poorly drained soil occupies low, caplike ridges and mounds. These areas range from 2 to 60 acres in size and generally are longer than they are wide.

Included with this soil in mapping are many, small, scattered spots and small areas where the underlying clay occurs at a depth of less than 18 inches or of more than 40 inches. Also included are small areas that have considerable amounts of gravel in the upper sandy loam materials.

Wetness, low fertility, and the clayey underlying materials are the main limitations of this soil. Drainage is difficult to establish because of the highly variable thicknesses of the sandy loam materials and the very slow permeability of the underlying clay. This soil is moderately suited to locally adapted crops. Most of these areas have been cleared and cultivated, but many areas are now idle. The few remaining wooded areas have stands of second-growth hardwoods. Capability unit IIIw-7 (4/1b); woodland group 3w2.

Use and Management of the Soils

This section explains the capability grouping used by the Soil Conservation Service and discusses use and management of the soils for crops. It also includes a table showing predicted yields of the principal crops under two levels of management and discusses use and management of the soils for woodland, wildlife, and community development. In addition, the section gives estimated engineering properties of the soils and interpretations of soil properties that influence engineering use.

Capability Grouping[2]

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 rice, cranberries, 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 interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for 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.

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

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

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

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

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife. (None in St. Clair County.)

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

Class VIII soils and landforms have limitations that preclude their use for commercial plants and re-

[2] RICHARD H. DRULLINGER, agronomist, Soil Conservation Service, helped prepare this section.

strict their use to recreation, wildlife, or water supply, or to esthetic purposes.

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

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. 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 this section the capability units in St. Clair County are described and suggestions for the use and management of the soils in each unit are given. The units are not numbered consecutively, because not all of the units used in Michigan are represented in this county.

In this soil survey, the management system used in Michigan is designated by symbols that are in parentheses and follow the symbols for the capability units in the system used by the Soil Conservation Service. For example, in capability unit I-1 (2.5a, 1.5a), capability unit I-1 designates the unit in the system of the Soil Conservation Service described in the preceding subsection, and 2.5a, 1.5a designates the management group in the Michigan system. These groups are used for making recommendations about applications of lime and fertilizer, about artificial drainage, and about other practices. For an explanation of this classification, refer to "Fertilizer Recommendations for Michigan Vegetable and Field Crops" (*5*).

Certain practices basic to good soil management can be mentioned before discussing the individual capability units. An adequate supply of plant nutrients and organic matter, a good root zone, and the proper balance of air and water are necessary if crops are to be grown efficiently. Management practices needed to improve crop growth include drainage, control of erosion, rotation of crops, use of suitable crop varieties, and the adequate use of lime and fertilizer. Lime and fertilizer should be applied according to soil tests and the needs of the crops.

Most of the soils in St. Clair County need artificial drainage. Drainage of cropland improves the air-water relationship in the root zone. Tile drains or surface drainageways, or both, can be used to remove excess water, but they should be designed to function properly. Land smoothing to correct irregularities of the surface will supplement the drainage system. Good soil structure and an ample supply of organic matter also benefit soil drainage.

The loss of surface soil through erosion reduces crop growth. Erosion generally can be controlled by reducing the rate and volume of runoff and by increasing the rate of water absorption by the soil. Growing meadow crops, cover crops, or green-manure crops and the proper use of crop residues help to reduce surface runoff. Contour cultivation, stripcropping, grassed waterways, minimum tillage, and the use of diversions and terraces are other measures effective in controlling erosion.

Practices to maintain and improve the organic-matter content and soil tilth include the growing of cover crops, stubble mulching, minimum tillage, the growing of green-manure crops, and the application of barnyard manure. Fall plowing on loamy and clayey soils, at the right moisture content, helps maintain soil tilth and allows earlier tillage of the soils in the following spring. Grazing loamy and clayey soils when they are wet should be avoided, as it results in compaction of the soils and poor soil tilth. These practices are needed most if the rotation of crops is intensive or if cultivation is continuous.

Additional help in managing the soils can be obtained by consulting the local representatives of the Soil Conservation Service or the Cooperative Extension Service.

The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all the soils of a given series appear in the unit. To find the names of all soils and the capability unit in which each one has been grouped, refer to the "Guide to Mapping Units" at the back of this survey. Borrow pits and Made land are not in a capability unit.

Capability unit I-1 (2.5a, 1.5a)

This capability unit consists of Miami-Dighton sandy loams, 0 to 2 percent slopes. These soils occur next to each other in areas too small and intricately associated to be mapped separately. The Miami and Dighton soils are both well drained and are level to nearly level. They formed in loamy glacial till. The Miami and Dighton soils have a loamy subsoil. The Dighton soil is underlain by sandy material at a depth of 20 to 40 inches.

Permeability of the Miami soil is moderately slow in the subsoil, and that of the Dighton soil is moderate in the subsoil and very rapid in the underlying materials. Available water capacity is high for the Miami soil and moderate for the Dighton soil. The Dighton soil is slightly more droughty than the Miami soil, because of the underlying sand at a depth of 20 to 40 inches. Both of these soils have high natural fertility. Surface runoff is slow, and the hazard of erosion is very slight. The content of organic matter in the surface layer is low to moderate.

The soils of this unit have very few limitations and are well suited to most locally adapted crops. Corn, small grains, white beans, alfalfa-brome hay, sugar beets, and soybeans are the main crops grown. These soils are well suited to farming. Both the Miami and Dighton soils can be cropped intensively if the fertility, organic-matter content, and tilth of the plow layer are maintained.

Capability unit IIe–2 (2.5a, 1.5a)

This capability unit consists of Miami-Dighton sandy loams, 2 to 6 percent slopes. These soils occur next to each other in areas too small and intricately associated to be mapped separately. They are both well drained and are gently sloping to undulating. Both of these soils formed in loamy glacial till materials. They have a loamy subsoil. The Dighton soil is underlain by sandy material at a depth of 20 to 40 inches.

The permeability of the Miami soil is moderately slow in the subsoil, and that of the Dighton soil is moderate in the subsoil and very rapid in the underlying material. Available water capacity is high for the Miami soil and moderate for the Dighton soil. The Dighton soil is slightly more droughty than the Miami soil, because of underlying sand at a depth of 20 to 40 inches. Both of these soils have high natural fertility. Surface runoff is slow to medium, and the erosion hazard is moderate. The organic-matter content of the surface layer is low to moderate.

The moderate erosion hazard is the main limitation of the soils in this unit. Otherwise, they are well suited to most locally adapted crops. The main crops grown are corn, small grains, white beans, alfalfa-brome hay, sugar beets, and soybeans. These soils can be farmed intensively if erosion is controlled and if the fertility, organic-matter content, and tilth of the plow layer are maintained. Minimum tillage, crop rotations that include winter cover crops and legume-grass hay crops, and contour farming can be used to control erosion. Terracing and stripcropping also can control erosion and allow more intensive cropping, but most areas of the Miami and Dighton soils are not well suited to these practices.

Capability unit IIw–2 (1.5b, 1.5c, 1.5c–c)

This capability unit consists of soils of the Blount, Jeddo, Lenawee, Sims, and Thomas series. The Blount soil is somewhat poorly drained, the Lenawee and Sims soils are poorly drained, and the Jeddo and Thomas soils are very poorly drained. All of these soils are level to nearly level. The Blount, Jeddo, and Sims soils formed in loamy glacial till and have a loamy and clayey subsoil and a loamy surface layer. The Lenawee and Thomas soils formed in dominantly loamy, water-laid sediments. They have a loamy subsoil that has some thin clayey layers and a loamy surface layer.

Soils of this unit have moderately slow to slow permeability. Available water capacity and natural fertility are high. Surface runoff is slow for the Blount soils and very slow for all of the other soils, which are subject also to periodic ponding. All of these soils have a seasonally high water table. But the somewhat poorly drained Blount soil is quicker to dry out and warm up in spring, and it has a lower water table in midsummer than the poorly or very poorly drained soils. The Blount soil has a moderate content of organic matter in the surface layer, and the other soils of this unit have a high content of organic matter. The Jeddo soil is more acid in the plow layer and the upper part of the subsoil than the other soils. The Thomas soil has a higher content of organic matter in the plow layer than the other soils of this unit, and it has free lime near or at the surface.

The major limitations of the soils in this capability unit are wetness and the moderately slow to slow permeability. The acid reaction of the Jeddo soil and the limy surface layer of the Thomas soil are additional limitations. Where adequately drained, the soils in this unit are well suited to most locally adapted crops. Corn, small grains, white beans, and alfalfa are the main crops, but vegetables, sugar beets, and soybeans (fig. 9) also are grown. Soils of this unit can be farmed intensively if the fertility, tilth, and organic-matter content of the plow layer are maintained. All these soils need both surface and subsurface drainage.

Shallow field ditches and land smoothing will remove the surface water, and the excess internal water can be removed by complete tile drainage systems. Deep open ditches are used as drainage outlets for both the tile and surface systems. Diversion-type ditches are needed in some places to cut off surface runoff from adjoining upland areas. Minimum tillage and crop rotations that include deep-rooted legumes are needed to improve the permeability and drainage of the subsoil. The Thomas soil has a high lime content, and for some crops fertilizers that contain minor elements and high amounts of phosphorous may be needed. The acid Jeddo soil needs special liming programs for the best growth of the common crops.

Capability unit IIw–3 (1.5b, 1b, 1.5c)

This capability unit consists of soils of the Blount, Pert, and Sims series. The Blount and Pert soils are somewhat poorly drained, and the Sims soil is poorly drained. The Blount and Pert soils are gently sloping and occur in undulating areas. The Sims soil is nearly level and occurs only in a soil complex with a Pert soil. This Sims soil occupies small, slightly concave depressions, narrow drainageways, and depressional flats. All of these soils formed in limy, loamy glacial till and have a loamy and clayey subsoil and a loamy surface layer.

Soils of this unit have slow permeability. Available water capacity and natural fertility are high. Surface runoff is slow to medium for the Blount and Pert soils and very slow for the poorly drained Sims soil, which also is

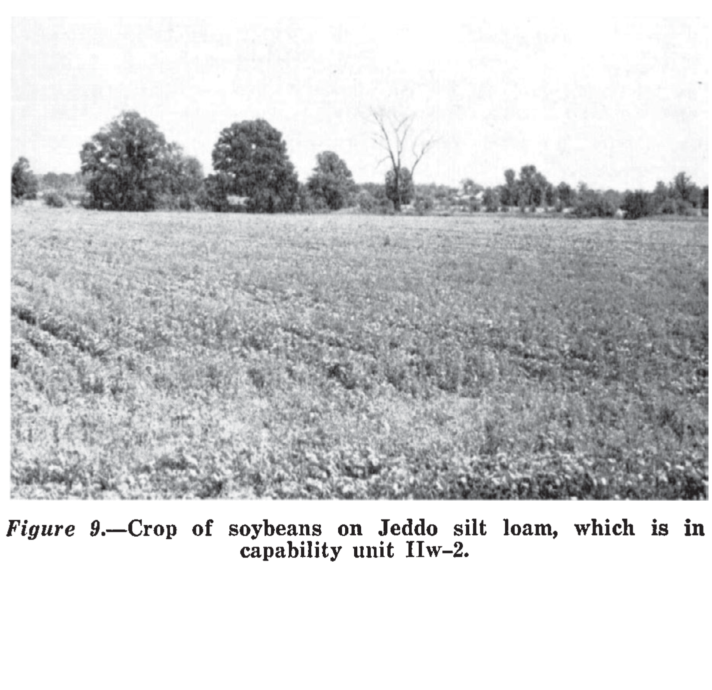

Figure 9.—Crop of soybeans on Jeddo silt loam, which is in capability unit IIw–2.

subject to ponding. All of these soils have a seasonal high water table, but the Sims soil is slower to dry out and warm up in the spring than the Blount or Pert soils. Also, the water table in the Sims soil remains higher during midsummer. The organic-matter content of the surface layer is moderate for the Blount and Pert soils and high for the Sims soil.

Wetness and the moderate erosion hazard are the main limitations to use. Where adequately drained, these soils are well suited to most of the locally adapted crops. Corn, small grains, white beans, and alfalfa are the main crops, but vegetables, sugar beets, and soybeans also are grown. These soils can be farmed intensively if the fertility, organic-matter content, and tilth of the plow layer are maintained, and erosion is controlled. Subsurface drainage is needed, and surface drainage is needed in poorly drained areas.

Tile drainage systems and open ditches will remove the excess internal water, but uniform drainage is difficult to obtain because of the sloping soils and uneven surface relief of the undulating areas. Shallow field ditches and grassed waterways are used to remove the surface water and control erosion. Many small depressions without outlets cannot be adequately drained by ditching. Stripcropping and terraces can be used to control erosion in a few places.

Capability unit IIw–4 (2.5b, 2.5c)

This capability unit consists of soils of the Conover, Londo, and Parkhill series. Conover and Londo soils are somewhat poorly drained, are level to nearly level, and occur on mounds and slightly convex rises. The Parkhill soils are poorly drained and occur in slightly concave depressions, narrow drainageways, and broad flat areas. One of the Parkhill soils occurs alone, and another is in a complex with a Conover soil in this unit. All of these soils formed in limy, loamy glacial till, and they have a loamy subsoil and surface layer.

Soils of this unit have moderate to moderately slow permeability, high available water capacity, and high natural fertility. Surface runoff is slow for the Conover and Londo soils and very slow for the Parkhill soils, which also are subject to ponding during wet periods and after heavy rains. All of these soils have a seasonal high water table, but the poorly drained Parkhill soils are slower to dry out and warm up in the spring and their water table remains higher in midsummer than the somewhat poorly drained Conover and Londo soils. The organic-matter content of the surface layer is moderate for the Conover and Londo soils and high for the Parkhill soils.

Wetness is the main limitation of these soils. Where adequately drained, all the soils of this unit are well suited to most locally adapted crops. Corn, small grains, white beans, and alfalfa are the main crops, but vegetables, sugar beets, and soybeans also are grown. These soils are good for farming. They can be cropped intensively if they are properly drained and if the fertility, tilth, and organic-matter content of the plow layer are maintained. Soils of this unit need both surface and subsurface drainage.

Shallow field ditches and land smoothing can be used to drain off the surface water. Some areas need diversion-type ditches to divert surface water from adjoining uplands. Tile drainage systems and open ditches remove the excess internal water. The regular use of alfalfa and other deep-rooted legumes in crop rotations helps to prevent surface compaction and to improve the permeability and internal drainage of the subsoil.

Capability unit IIw–5 (2.5b)

This capability unit consists of soils of the Conover and Londo series. These are somewhat poorly drained soils that are gently sloping. They occur on knolls and ridges that border on drainageways. The Conover and Londo soils formed in limy, loamy glacial till, and they have a loamy subsoil and surface layer.

These soils have moderate to moderately slow permeability and high natural fertility. They have a high available water capacity and a seasonal high water table. Surface runoff is medium, and the erosion hazard is moderate. The organic-matter content of the surface layer is moderate.

Wetness and the moderate erosion hazard are the major limitations of these soils for farming. Where drainage is adequate, these soils are well suited to most locally adapted crops. Corn, small grain, white beans, and alfalfa are the main crops, but sugar beets and soybeans also are grown. These soils can be farmed with fairly intensive cropping if erosion is controlled and if the fertility, tilth, and organic-matter content of the plow layer are maintained.

Excess subsurface water can be removed by tile drainage systems. Minimum tillage and crop rotations, including legumes and grasses, reduce runoff and control erosion. Cover crops are needed to check erosion in these areas when they are planted to row crops. Grassed waterways are needed in some places where concentrated flows of water from adjoining areas cross these soils.

Capability unit IIw–6 (3b, 3/1b, 3c, 2.5b–c, 2.5c–c)

This capability unit consists of soils of the Bach, Lamson, Minoa, and Sanilac series. The very poorly drained Bach soil and the poorly drained Lamson soil are in slightly concave depressions, narrow drainageways, and broad depressed flat areas. The Minoa and Sanilac soils are somewhat poorly drained and are level to very gently sloping. They occur on mounds, knolls, and rises. All of these soils formed in water-laid, limy, loamy and sandy materials. They have a dominantly loamy surface layer and subsoil. Minoa fine sandy loam, clay substratum, 0 to 3 percent slopes, is included in this unit. It is underlain by clayey and loamy materials at a depth of 30 to 50 inches.

Soils of this unit have moderate permeability and available water capacity. These soils have a moderate natural fertility. The poorly drained and very poorly drained soils have a high content of organic matter in the plow layer. Surface runoff is slow on the Minoa and Sanilac soils. The Bach and Lamson soils have very slow runoff, are subject to ponding of surface water, and in some areas are periodically flooded. Bach and Sanilac soils are limy at or near the surface, but in the Minoa and Lamson soils limy materials are at a greater depth.

Wetness and layers of very fine sandy loam, loamy very fine sand, and silt loam are the main limitations of the soils in this unit for farming. The high content of free lime also limits the Bach and Sanilac soils. Some small areas of Minoa soils that are gently sloping are moderately susceptible to erosion. Where adequately drained, the soils in this unit are well suited to most locally adapted crops. Corn, small grains, white beans, and alfalfa are the main crops, but vegetables, sugar beets, and soybeans also are grown. These soils can be farmed intensively if they are drained and if the fertility and organic-matter content of the plow layer are maintained.

Adequate drainage is difficult to establish and maintain. Where the sandy and silty materials of these soils are wet, they tend to flow, ditchbanks slough, and tile lines are plugged. Special methods of installation and blinding are needed for all tile drainage systems. Construction and installation of all drainage systems are dependent on dry weather. Some areas of the Bach and Sanilac soils are not farmable, because of their inaccessibility to vehicles or farm machinery. Fertilization programs for Bach and Sanilac soils should include needs for minor elements and higher amounts of phosphorous. Minimum tillage, crop rotations, and the use of winter cover crops are needed to control erosion on the gently sloping Minoa soil.

Capability unit IIw-8 (2.5c, 3/2b, 3/2c)

This capability unit consists of soils of the Corunna, Metamora, and Parkhill series. Corunna and Parkhill soils are poorly drained and occur in slightly concave depressions, nearly level drainageways, and depressed flats. The Metamora soils are somewhat poorly drained, are level to nearly level and gently sloping, and occur on slightly convex mounds, knolls, and low ridges. The Parkhill soil in this unit is in a soil complex with a Metamora soil. Corunna and Metamora soils are formed in 18 to 40 inches of loamy material over loamy glacial till. They have a loamy subsoil and surface layer. The Parkhill soil formed in loamy glacial till and has a loamy subsoil and surface layer.

Permeability of the Corunna and Metamora soils is moderately rapid in the upper part of their profiles and moderately slow in the lower part. Permeability of the Parkhill soil is moderately slow. The available water capacity is high for the Corunna and Parkhill soils and moderate for the Metamora soils. Natural fertility is high for the Corunna and Parkhill soils and moderate for the Metamora soil.

The organic-matter content of the plow layer is high in the Corunna and Parkhill soils and medium in the Metamora soils. Surface runoff is slow on the Metamora soils and very slow on the Corunna and Parkhill soils. All these soils have a seasonal high water table, but the poorly drained Corunna and Parkhill soils are slower to dry out and warm up in the spring, and their water table remains closer to the surface during midsummer than that in the somewhat poorly drained soils. Corunna and Parkhill soils also are subject to ponding.

Wetness is the main limitation affecting all of these soils. The gently sloping Metamora soil is moderately susceptible to erosion. Where adequately drained, these soils are well suited to most of the locally adapted crops. Corn, small grains, white beans, and alfalfa are the main crops, but vegetables (fig. 10) and soybeans also are grown. Where adequately drained, the soils of this unit can be farmed intensively if the fertility and organic-matter content of the plow layer are maintained. In areas that are gently sloping, erosion must be controlled if farming is intensive.

Figure 10.—**Cabbages growing on soils of the Metamora-Parkhill complex, 0 to 2 percent slopes, which is in capability unit IIw-8.**

Tile drainage systems can be used to remove excess internal water. Special blinding is needed to protect the tile lines in sandy spots, and in a few areas stones hinder installation and construction. Shallow field ditches and grassed waterways remove surface water, and deep open ditches provide outlets for both surface and subsurface drainage systems. Crop rotations that use legumes and grasses can be used to control erosion in areas of the sloping soils. Some areas are suited to contour tillage, but most areas of Metamora soils that have short, irregular slopes are not suited to contour farming, stripcropping, or terraces.

Capability unit IIw-10 (M/3c)

The only soil in this capability unit is Palms muck. Palms muck is very poorly drained and occurs in low slightly concave depressions and depressed, flat areas. This soil formed in well-decomposed organic material that is underlain at a depth of 16 to 50 inches by loamy mineral material. It has organic surface and subsurface layers.

Permeability of the organic upper material is very rapid and of the underlying loamy material is moderately slow. This shallow organic soil has a very high available water capacity, but the natural fertility is low. The organic upper part of the soil is very unstable, and support of farm machinery is unpredictable, especially when the soil is wet. This soil has a high water table and also is subject to frequent flooding and ponding.

Wetness, instability, low natural fertility, and the hazards of frost and soil blowing are the main limitations of this soil for farming. Where adequately drained, fertilized, and protected from erosion, this soil is well suited to corn, soybeans, vegetables, potatoes, and bluegrass sod.

Drainage systems that generally include deep open ditches and tile drains can be used to remove excess internal water. Ditches are needed around the outer edges of most areas of this soil to intercept both surface and subsurface water from the surrounding uplands. When this soil is first drained, it is subject to settling and subsidence as it begins to dry out. Enough time should be allotted for this subsidence before installing tile drains. Many areas lack adequate outlets for drainage systems. Fertilization programs that include minor elements are needed if crops are grown on this soil. Wind stripcropping, windbreaks, minimum tillage, and management of the water level can control soil blowing. Irrigation is needed for some high-value crops because, after drainage is established, this soil tends to be droughty in midsummer.

Capability unit IIIe-4 (1.5a)

The only soil in this unit is Morley loam, 6 to 12 percent slopes, eroded. This soil is well drained and moderately well drained. It formed in limy, loamy till materials and has a loamy and clayey subsoil.

Permeability is slow. The available water capacity is high, and the natural fertility is moderate. The organic-matter content of the plow layer is low. Surface runoff is rapid.

This soil is moderately well suited to most locally adapted crops, but the moderately severe hazard of erosion limits this soil from the most intensive cropping uses. Corn, small grains, and alfalfa are the main crops grown. If erosion is controlled and if the fertility, tilth, and organic-matter content of the plow layer are improved, this soil is productive.

Minimum tillage, contour farming, stripcropping, and suitable crop rotations that limit the use of row crops and include legumes and grasses will control erosion. Crop residues, winter cover crops, and green-manure crops reduce runoff and erosion. Grassed waterways are needed in areas where concentrated flows of water cross this soil from adjoining higher areas. Terraces are of only limited use on this soil mainly because the slopes are short, steep, and irregular. In a few places, however, diversion-type terraces can be used to protect the adjoining lowlands from runoff that comes from this soil.

Capability unit IIIe-5 (2.5a)

The only soil in this unit is Miami loam, 6 to 12 percent slopes. This well-drained soil formed in limy, loamy till and has a loamy subsoil.

Permeability of this soil is moderately slow. The available water capacity and the natural fertility are high. The organic-matter content of the plow layer is moderate. Surface runoff is rapid. Where this soil is cultivated, the erosion hazard is moderately severe.

The main limitation to the use of this soil is the erosion hazard, which limits use of this soil for the most intensive cropping. The soil is moderately well suited to most locally adapted crops. Corn, small grains, and alfalfa are the main crops grown. If erosion is controlled and if the fertility, tilth, and organic matter content of the plow layer are maintained, this soil is productive.

Minimum tillage and a suitable crop rotation that limits the use of row crops and includes legumes and grasses can be used to control erosion. Contour farming, stripcropping, and terraces are impractical because of the small size, short slopes, and irregular shapes of the areas of this soil. Crop residues, winter cover crops, and green-manure crops reduce surface runoff and erosion. Grassed waterways are needed in a few areas where runoff is concentrated.

Capability unit IIIe-9 (4a)

The only soil in this unit is Rousseau fine sand, 6 to 12 percent slopes. It is a well-drained soil and occurs on sloping knolls, on low ridges, and in rolling areas. It formed in stratified sandy deposits and has a sandy subsoil.

Permeability is rapid. The available water capacity and natural fertility are low. The organic-matter content of the plow layer is low. Surface runoff on this soil is slow. The hazard of water erosion and soil blowing is moderately severe.

Droughtiness, low natural fertility, and the moderately severe hazard of erosion are the main limitations of this soil. This soil is moderately suited to small grains and alfalfa hay. Because of its low available water capacity, this soil is of limited use for producing corn and other intensively cultivated row crops.

Where this soil is farmed, minimum tillage, a suitable crop rotation, winter cover crops, and crop residue management are needed to control erosion. Most areas of this soil are too small in size and too irregularly shaped for contour farming or stripcropping. A good stand of legumes and grasses and the prevention of overgrazing are needed for productive pasturing.

Capability unit IIIw-1 (1c, Oc)

This capability unit consists of soils of the Latty, Paulding, and Toledo series and the Latty series, sandy subsoil variant. These soils are mostly very poorly drained and occur in broad flat areas and in small and narrow depressions. The normal Latty soils formed in lacustrine clayey material, but the Latty soils, sandy subsoil variant, formed in 20 to 40 inches of lacustrine clayey material over sand. The Toledo soil formed in lacustrine clayey sediments that have thin loamy and sandy layers. This soil and the normal Latty soils have a clayey subsoil and a loamy surface layer. The Paulding soil formed in lacustrine clayey material and has a clayey subsoil and surface layer.

This capability unit consists partly of complexes in which some of the soils are somewhat poorly drained. These soils are on knolls, mounds, and low ridges, whereas the major soils in the unit are very poorly drained and are on slightly concave depressions, drainageways, and flat areas.

The soils in this unit have slow to very slow permeability. They have a moderate available water capacity and high natural fertility. Surface runoff is slow to very slow, and the very poorly drained soils are subject to periodic ponding. All of these soils have a seasonal high water table, but the somewhat poorly drained soils are quicker to dry out and to warm up in spring than the very poorly drained soils, and their water table is lower in midsummer. These soils have a high organic-matter content.

Wetness, a high clay content, and slow to very slow permeability are the main limitations of these soils. The soils are slow to warm up and dry out in spring. Removal of surface water and tile drainage are difficult to establish in many areas. The sandy subsoil of the Latty complex, sandy subsoil variant, flows when it is wet and causes unstable ditchbanks and plugged tile lines. Where adequately drained, these soils are moderately suited to most locally adapted crops. Crop growth is somewhat limited on the Paulding soil. Corn, small grain, white beans, and alfalfa are the main crops. The Latty and Paulding soils are poorly suited to sugar beets and white beans.

Excess surface water can be removed by shallow field ditches, land smoothing, and tile drainage systems. Diversion ditches are needed in some areas to reduce runoff from adjoining upland areas. Deep, open ditches are required for drainage outlets for both surface and tile systems. The tile installed in soils of the Latty complex, sandy subsoil variant, requires special blinding if it is laid in the sandy layer. Minimum tillage, plowing at the right moisture content, and a crop rotation that includes deep-rooted legumes can be used to improve the tilth, drainage, and organic-matter content.

Capability unit IIIw-2 (1b, 1c)

This capability unit consists only of the Nappanee-Hoytville complex, 0 to 3 percent slopes. The soils in this complex occur next to each other in areas too small and too intricately associated to be mapped separately. The Nappanee soil is somewhat poorly drained and occurs on higher, slightly convex mounds, knolls, and low rises. The Hoytville soil is very poorly drained and occurs in the lower, slightly concave depressions, narrow drainageways, and depressed level areas. These soils formed in limy, clayey glacial till. They have a clayey subsoil and a loamy surface layer.

Permeability of these soils is slow. Available water capacity is moderate. These soils have a high natural fertility. Surface runoff is very slow to ponded for the Hoytville soil and slow for the Nappanee soil. Both soils have a seasonal high water table. The organic-matter content in the surface layer is high for the Hoytville soil and moderate for the Nappanee soil.

Wetness and slow permeability are the main limitations of these soils. They are moderately suited to most crops. Drainage is needed for most crops because of ponded surface water and poor soil tilth. Alfalfa, mixed hay, corn, wheat, and oats are the main crops.

Shallow ditches, sodded waterways (fig. 11), and land smoothing aid in the removal of surface water and control erosion. Tile drainage systems remove excess internal water, but they are difficult to establish because of the gently undulating and depressional areas. The use of deep-rooted crops improves the drainage and permeability of these soils.

Figure 11.—**A well-maintained sodded waterway that drains 140 acres of cropland without erosion. It is on soils of the Nappanee-Hoytville complex, 0 to 3 percent slopes, which is in capability unit IIIw-2.**

Capability unit IIIw-5 (4a, 4b, 4c, 5c-c)

This capability unit consists of soils of the Boyer, Deford, Otisco, Tobico, Wainola, and Wasepi series. The Boyer soil of this unit is part of the Wasepi-Boyer complex, loamy substratum, 0 to 6 percent slopes. The Deford soil is part of the Wainola-Deford fine sands, 0 to 2 percent slopes. The Tobico soil is part of the Wainola-Tobico complex, 0 to 3 percent slopes. In each complex the soils occur next to each other in areas too small and intricately associated to be mapped separately.

The well-drained Boyer soil is level to gently sloping and formed in 20 to 40 inches of loamy and sandy material over limy sand and gravel. This soil has a sandy and loamy subsoil and a sandy surface layer. The very poorly drained Deford and Tobico soils are depressional to nearly level. They formed in water-laid sandy material. The Deford soil has a sandy subsoil and surface layer. The Tobico soil has a sandy subsurface layer and a mucky and sandy surface layer. The somewhat poorly drained Otisco, Wainola, and Wasepi soils are level to slightly undulating. The Otisco soil formed in sandy deposits and has a sandy and loamy subsoil and a sandy surface layer. The Wainola soils formed in water-laid sandy material and have a sandy subsoil and surface layer. The Wasepi soil formed in 24 to 42 inches of sandy and loamy material over sand and gravel; it has a sandy and loamy subsoil and a loamy surface layer. Soils of the Wasepi-Boyer complex, loamy substratum, are underlain by loamy material at a depth of 42 to 66 inches.

The Boyer and Wasepi soils have moderately rapid permeability, and the Deford, Otisco, Tobico, and Wainola soils have rapid permeability. Soils of the Wasepi-Boyer complex, loamy substratum, have moderate available water capacity, and the other soils have a low available water capacity. All the soils are low in natural fertility. Surface runoff ranges from medium to very slow. The Deford and Tobico soils are subject to periodic ponding. All of these soils, except the Boyer soil, have a seasonal high water table. The Boyer, Otisco, Wainola, and Wasepi soils dry out and warm up more quickly in the spring than the Deford and Tobico soils. The organic-matter content of these soils ranges from low to high. The Tobico soil is mildly alkaline in the surface layer.

The major limitations of the soils in this unit are wetness and, except in the Boyer soil, low natural fertility. The uneven surface relief of the soil complexes and midsummer droughtiness are additional limitations. Very few areas of the Wasepi-Tobico complex are cropped. The other soils and soil complexes are moderately suited to the growing of crops. Corn, small grains, white beans, and alfalfa are the main crops. Vegetables and soybeans also are grown. Sugar beets are poorly suited to these soils. Most areas of these soils need subsurface drainage.

Excess internal water can be removed by tile drainage. The sandy material and the uneven surface relief in some areas make these soils difficult to drain. When saturated with water, these sandy soils tend to flow, and this causes caving of ditchbanks and plugging of tile lines. Special blinding of the tile is required. The Tobico soil has a high lime content, and fertilizers that contain minor elements and that have a high amount of phosphorous may be needed for some crops.

Capability unit IIIw-6 (4c)

This capability unit consists of level to nearly level soils of the Gilford and Deford series. The poorly drained

Gilford soil and very poorly drained Deford soil are on broad, depressed flats, in small, slightly concave depressions, and in narrow drainageways. The Gilford soil formed in 24 to 40 inches of loamy and sandy material over limy sand. They have a loamy and sandy subsoil and a loamy surface layer. The Deford soil formed in water-laid sandy deposits. This soil has a sandy subsoil and surface layer.

The Gilford soil has a moderately rapid permeability, and the permeability of the Deford soil is rapid. The available water capacity and natural fertility of both soils are low. The water table is near the surface during most of the year, and surface runoff is very slow. These soils are subject to ponding during wet periods. They have a high content of organic matter in their surface layer.

Wetness and low natural fertility are the main limitations of these soils. Where these soils are adequately drained and fertilized, they are moderately suited to most locally adapted crops. Corn, small grains, beans, and alfalfa are the main crops. Vegetables also are grown. Sugar beets are poorly suited.

Tile drainage systems remove excess internal water. These soils can be overdrained, and then they become droughty during midsummer. On the Deford soil, drainage is difficult to establish and maintain. The fine sands of the Deford soil tend to flow when wet, and this results in caving of ditchbanks and plugging of tile lines. Special blinding is needed to protect the tile lines. Both the Deford and the Gilford soils need heavy fertilization, lime, and irrigation for intensive farm use.

Capability unit IIIw-7 (4/1b)

This capability unit consists of soils of the Allendale and the Wasepi, clay subsoil variant, series. These soils are somewhat poorly drained and are nearly level or very slightly undulating. The Allendale soil formed in 18 to 40 inches of water-laid sandy material over clay. It has a sandy subsoil and surface layer. The Wasepi soil, clay subsoil variant, formed in 18 to 40 inches of loamy and sandy material over clay. It has a dominantly loamy subsoil and surface layer.

Permeability is rapid and moderately rapid in the upper sandy and loamy part of these soils and very slow in the lower clayey part. Available water capacity in the sandy and loamy upper part is low to moderate and is moderate in the lower clayey part. These soils have low natural fertility. They have a seasonal high water table, and surface runoff is slow. The organic-matter content is low to moderate.

The main limitations of these soils are the fluctuating high water table, low natural fertility, and midsummer droughtiness. These soils are moderately suited to use for crops. Heavy fertilization and other practices to build up organic matter in these soils are needed. Most areas of these soils have been cleared and cultivated. Largely, they are now idle or used for permanent pasture. Corn, small grain, soybeans, and alfalfa are grown in some areas. White beans and sugar beets are poorly suited to these soils.

Tile drainage systems can be used to remove excess internal water. Special blinding is needed to protect the tile lines in the sandy material. The very slow permeability in the clayey lower part makes it difficult to install tile drainage systems in some areas. Because the sandy material tends to cave into the trenches and ditches when it is wet, the lines should be installed during dry periods.

Capability unit IIIw-8 (4/1c)

The only soil in this capability unit is Pinconning mucky fine sand. This soil is very poorly drained and occupies depressed flats and level areas. It formed in 18 to 40 inches of sandy material over clay. It has a sandy subsoil.

Permeability of this soil is rapid in the sandy upper part and very slow in the clayey lower part. Available water capacity in the sandy upper part is low, and in the lower clayey part it is moderate. The natural fertility is low. Surface runoff is very slow to ponded. The water table is near the surface during most of the year. The organic-matter content is high in the surface layer.

Wetness and low natural fertility are the main limitations for use of this soil. It is moderately suited to use for crops. Heavy fertilization is needed. Corn, small grains, white beans, and alfalfa are the main crops. Sugar beets are poorly suited to this soil. Vegetable crops have been grown successfully in some areas.

Drainage is needed before crops can be grown. Adequate drainage is difficult to establish because the fine sand tends to flow when wet and to fill up the tile lines or ditches. Special blinding is needed to protect the tile lines. The very slow permeability of the clayey materials gives additional difficulty in draining. Fertilization and crop rotations that include legumes and grasses improve the fertility of this soil.

Capability unit IIIw-9 (4/2b, 2.5b)

This capability unit consists of soils of the Avoca series and the Londo complex, 0 to 2 percent slopes. These soils are somewhat poorly drained and are level to very gently sloping and slightly undulating. The Avoca soil formed in 18 to 40 inches of sandy material over loamy till. It has a sandy subsoil and surface layer. Soils of the Londo complex formed in loamy till. These soils have a loamy subsoil. About 40 to 60 percent of this complex has a sandy upper part, 10 to 20 inches thick, and the balance of the complex is loamy. The soils in this complex occur next to each other in areas too small and too intricately associated to be mapped separately.

Permeability is rapid in the upper sandy part of the Avoca soil and in the thin, sandy part of the Londo complex. Permeability is moderately slow in the lower clayey part of the Avoca soil and moderate in the loamy part of the Londo complex. Available water capacity is low in the upper part of the Avoca soils and in the sandy part of the Londo complex and is high in the lower part of the Avoca soil and in the loamy part of the Londa complex. Natural fertility is low in the Avoca soil and in the sandy part of the Londo complex and high in the loamy part of the Londo complex. Surface runoff is slow. These soils have a seasonal high water table.

Wetness, the contrasting differences in texture of the soils in the Londo complex, and the low natural fertility of the Avoca soil and much of the Londo complex are the main limitations of these soils for farm use. The soils are moderately suited to most locally adapted crops. Corn, small grains, white beans, and alfalfa are the main crops, but soybeans and sugar beets are also grown. These soils have some potential for specialized cropping, such as vegetables, ornamental nursery stock, and small fruits and berries. Climate, size of areas, irrigation water needs, and the high natural lime content need to be considered before beginning large scale operations. Because the surface layer is thin and sandy in many places, it is difficult to fertilize crops properly, and the variable textures make the Londo complex hard to till. The loamy areas are slow to warm up and dry out in spring, and the sandy areas have a low natural fertility and become droughty in midsummer.

Tile drainage systems can be used to remove excess internal water. On the Avoca soil, drainage is hindered by tendency of the fine sands to flow when wet, and by the caving of ditchbanks and plugging of tile lines. On the Londo soils, uniform drainage is difficult to obtain because of the variable textures. Land leveling is needed in some areas of the Londo complex.

Capability unit IIIw-11 (4/1b, 1.5c, 1c)

This capability unit consists of soils of the Allendale, Hoytville, Latty, Lenawee, and Toledo series. These soils all occur in complexes—the Allendale-Hoytville complex, 0 to 6 percent slopes; the Allendale-Latty complex, 0 to 3 percent slopes; and the Allendale-Lenawee-Toledo complex, 0 to 3 percent slopes. The soils of these complexes are in areas too small and too intricately associated to be mapped separately.

The Allendale soils are somewhat poorly drained and occur on the higher, slightly convex, domelike mounds and low ridges. These soils formed in 18 to 40 inches of water-laid sandy material over clay and have a sandy subsoil and surface layer.

The poorly drained Lenawee soils and the very poorly drained Hoytville, Latty, and Toledo soils are in the lower, slightly concave depressions, drainageways, and level areas. The Lenawee soils formed in loamy water-laid sediments and have a loamy and clayey subsoil and a loamy surface layer. The Hoytville soils formed in clayey glacial till, and the Latty and Toledo soils formed in dominantly clayey lacustrine sediments. These soils have a clayey subsoil and a loamy surface layer.

The permeability in the Latty soils is very slow, in the Hoytville and Toledo soils it is slow, and in the Lenawee soil it is moderately slow. The permeability in the Allendale soils is rapid in the upper sandy 18 to 40 inches and very slow in the lower clayey part. The available water capacity is high for the Lenawee and Toledo soils, moderate for the Hoytville and Latty soils, and low for the Allendale soils. The natural fertility is low in the Allendale soils and high in the other soils. Surface runoff is slow to very slow or ponded. Organic-matter content of the surface layer is low for the Allendale soils and generally high for the other soils.

Wetness and the extreme textural differences between the soils of each complex are the main limitations. The sandy soils of the complexes are droughty during midsummer, and they have a low natural fertility and are moderately susceptible to erosion. The clayey soils are slow to dry up in spring and occur in areas too widely scattered and small to be properly drained. Land leveling and tile drainage practices are difficult to establish. These soils are moderately suited to use for crops. Corn, small grains, white beans, and alfalfa are the main crops. Soybeans and sugar beets are also grown. Sugar beets are poorly suited to the Allendale-Latty complex. Removing excess surface water and maintaining good tilth are important needs for the clayey soils.

Uniform drainage is difficult to obtain because of the variable permeability of the clayey parts of the complexes and the undulating surface relief of the sandy parts. Tilling the clayey soils when they are wet tends to destroy the soil structure and results in poor tilth. Minimum tillage, leaving the surface rough, planting small grains in narrow strips, and using crop rotations that include deep-rooted legumes and grasses improve the tilth, permeability, and drainage of the clayey soils.

Capability unit IIIw-12 (3b-3c)

This capability unit consists of soils of the Minoa-Lamson complex, 0 to 3 percent slopes. These soils occur next to each other in areas too small and too intricately associated to be mapped separately. The Minoa soil is somewhat poorly drained, and the Lamson soil is poorly drained. These soils are level to very gently sloping and generally have a very gently undulating surface. They formed in loamy and sandy water-laid sediments. The Minoa soil has a loamy and sandy subsoil and a loamy surface layer. The Lamson soil has a loamy subsoil and surface layer.

Permeability of these soils is moderate. Available water capacity is moderate. These soils have moderate natural fertility. Surface water runoff is slow on the Minoa soil, and it is very slow on the Lamson soil, which also is subject to ponding. The soils of this complex are subject to frequent flooding and have a seasonal high water table. The poorly drained Lamson soil is slower to dry out and warm up in spring than the somewhat poorly drained Minoa soil, and its water table remains closer to the surface in midsummer. The poorly drained Lamson soil has a high organic-matter content in the plow layer, and the Minoa soil has a moderate content of organic matter.

Wetness and flooding of these soils are the main limitations for farm use. These soils are moderately suited to some cultivated crops, but they are best suited to pasture and hay crops. Lack of an adequate outlet severely limits the draining of many areas. The hazard of flooding is most severe early in spring. Many of these areas are relatively inaccessible because of the meandering riverbeds and the bordering river bluffs.

Capability unit IIIw-15 (Mc)

The only soil in this capability unit is Houghton muck. This soil is very poorly drained. It occupies large, level areas and small, slightly concave depressions. Houghton muck formed in 51 inches or more of well-decomposed organic material, and it has organic surface and subsurface layers.

Permeability is very rapid, and available water capacity is very high. Natural fertility is low. The Houghton soil is very unstable. It has a high water table and is subject to frequent ponding by surface runoff. Organic-matter content is very high.

Wetness, instability, low natural fertility, and the hazards of frost and soil blowing are the main limitations of this soil. Where it is adequately drained, fertilized, and protected from erosion, this soil is moderately suited to corn, soybeans, vegetables, potatoes, and bluegrass sod. In a few places, sugar beets are grown.

Drainage systems that generally include deep, open ditches and tile drains will remove excess water. Drainage systems are generally difficult to install because of subsidence, lack of outlets, and unstable materials. Sufficient time should be allotted for subsidence before installing tile drains. Ditches are needed around the outer edges of most areas of this soil to intercept both surface and subsurface waters from the surrounding uplands. Fertilization programs that include minor elements are needed for most crops on this soil. Wind stripcropping, windbreaks, minimum tillage, and management of the water level will control soil blowing. Irrigation is needed for most high-value crops, because after drainage is established this soil tends to be droughty in midsummer.

Capability unit IIIs-3 (4a)

The only soil in this capability unit is Spinks loamy sand, 0 to 2 percent slopes. This soil is well drained and is level to nearly level. It formed in sandy and gravelly material and has a banded, sandy subsoil and a sandy surface layer.

Permeability is rapid, and the available water capacity is low. The natural fertility and the organic-matter content of the plow layer are low. Surface runoff is slow.

Droughtiness and the low natural fertility are the main limitations of this soil. It is moderately suited to general farming. Production of most crops is limited by the lack of water and plant nutrients. Corn, small grains, and alfalfa hay are the main crops grown. This soil is better suited to small grains and alfalfa than to corn or other row crops. Some areas of this soil have a potential for raising ornamental shrubs, small fruit, vegetables, flowers, and tree fruit.

Minimum tillage, rotations that use legumes and grasses, wind stripcropping, winter cover crops, and use of crop residue conserve moisture and improve fertility of this soil for farm use. This soil requires irrigation for growing of high-value crops and other intensive farm uses.

Capability unit IIIs-4 (4a, 4/2a)

This capability unit consists of soils of the Boyer, Metea, Rousseau, and Spinks series. These soils are well drained and are nearly level to gently sloping. They occur in mounds, knolls, low ridges, and undulating areas. The Boyer soil formed in 24 to 40 inches of sandy and loamy soil material over limy sand and gravel. The Metea soil formed in 18 to 40 inches of sandy and loamy material over loamy glacial till. Both soils have a sandy and loamy subsoil and a sandy surface layer. The Rousseau soil formed in sandy materials, and the Spinks soils in sandy and gravelly deposits. Rousseau and Spinks soils have a sandy subsoil and surface layer. The Spinks soil that has a loamy substratum is underlain at a depth of 42 to 66 inches by loamy material.

The permeability of all of these soils is dominantly rapid to moderately rapid. The available water capacity and natural fertility are low. Surface runoff is slow to medium. The organic-matter content of the plow layer is low. Permeability of the underlying loamy material in the Metea soil and in the Spinks soil that has a loamy substratum is moderately slow.

Droughtiness, low natural fertility, and a moderate erosion hazard are the main limitations. These soils are moderately suited to common crops in the county. Corn, small grains, and alfalfa are the main crops grown, but these soils are better suited to small grains and alfalfa than to corn. Some areas have potential for growing of ornamental shrubs, small fruit, vegetables, flowers, and tree fruit.

Minimum tillage, rotations that use legumes and grasses, stripcropping, winter cover crops, and crop residue management are required to control erosion and conserve moisture in areas of these soils that are farmed. Most of the high-value crops require irrigation, and the hazard of erosion makes it difficult to apply adequate amounts of water for more than short periods of time.

Capability unit IVe-1 (1.5a)

The only soil in this unit is Morley loam, 12 to 18 percent slopes, eroded. This soil is well drained. It formed in limy, loamy glacial till materials. It has a loamy and clayey subsoil and a loamy surface layer.

Permeability of this soil is slow. The available water capacity is high, and the natural fertility is moderate. Surface runoff is rapid, and the organic-matter content of the plow layer is low. Corn, small grains, and alfalfa are the main crops grown.

In cultivated areas, this soil is poorly suited to intensive cropping because the erosion hazard is severe.

Where areas of this soil are farmed, minimum tillage, crop residue management, and crop rotations that use small grains, legumes, and grasses are effective in reducing runoff and controlling erosion. Contour farming and stripcropping are difficult in most areas of this soil because of short, steep, and irregular slopes. Grassed waterways are needed in areas where surface runoff is concentrated.

Capability unit IVs-4 (5a, 3c)

This capability unit consists of soils of the Chelsea, Croswell, and Lamson series. The well drained Chelsea and the moderately well drained Croswell soils are level to gently undulating and occur on uplands. The poorly drained Lamson soil occurs in low, slightly concave depressions, narrow drainageways, and depressed flats. The Croswell soils occur in complexes with the Chelsea and the Lamson soils. The Chelsea and Croswell soils formed in sandy deposits and have a sandy subsoil and surface layer. The Lamson soil formed in water-laid, loamy and sandy material. It has a loamy subsoil and surface layer.

Permeability of the Chelsea and Croswell soils is rapid, and the available water capacity is low. These soils have a low natural fertility and low organic-matter content in the plow layer. Surface runoff is slow. Permeability of the Lamson soil is moderate, and the available water capacity is moderate. This soil has moderate natural fertility and a high organic-matter content in the surface layer. Surface runoff is very slow to ponded. The Lamson soil has a high water table.

Droughtiness and low fertility are the main limitations of the Chelsea and Croswell soils. In cultivated areas, these soils are subject to moderate erosion. Wetness and the small scattered areas of the Lamson soil are the main limitations of this soil for farm use. All of these soils are generally poorly suited to crops.

General cropping requires practices that control erosion, conserve moisture, and maintain or improve fertility and the organic-matter content of the plow layer. Crop rotations, minimum tillage, crop-residue management, winter

446-054—74——5

cover crops, and, where practical, contour farming and stripcropping improve these soils and control erosion. Irrigation is needed where areas of these soils are used for the production of vegetables, ornamental shrubs, or other high-value crops. The Lamson soil needs drainage. Adequate drainage is difficult to obtain because the Lamson soil occurs in many small, separate depressions and in narrow, winding drainageways that generally lack convenient outlets.

Capability unit Vw-3 (L2c)

This capability unit consists only of Alluvial land. In most places this land type is level to gently sloping, though it is strongly sloping to steep on many, very short side slopes along the banks of the old stream meanders and river channels. The land type occurs on flood plains of major rivers and streams throughout the county. The soils consist of stratified mineral material that ranges from sand to silty clay. Within short distances, drainage is variable and ranges from good to poor. The natural fertility, available water capacity, and permeability are variable.

The main limitations of this land type for farming are flooding, the variability of soil texture, slope, wetness, and inaccessibility. Drainage systems are difficult to install because of the choppy surface and the lack of proper outlets. Many potentially usable areas are inaccessible to farm machinery and to other uses because of the steep bluffs or meandering riverbeds. A few areas are planted to corn, and some areas are pastured.

Capability unit VIIe-2 (Sa)

This capability unit consists only of Rough broken land, a miscellaneous land type. It is steep and very steep and occurs on bluffs and in deep, narrow, gully-like areas that border on the flood plain of the Black River. Slopes range from 18 to 80 percent. The soil materials range from clay loam to sand, but loam and clay loam till material is dominant in most areas. In many places the soil materials are exposed in clifflike banks that are almost vertical.

This land type has side-hill seep spots and springs. Erosion, soil creep, and landslides are severe hazards. Rough broken land is not suited to cultivated crops. Pasture growth is fair in some small areas.

Capability unit VIIs-1 (5.3a)

The only soils in this capability unit are of the Eastport series. These soils are well drained. They are nearly level to strongly sloping and occur on old lake beaches. These soils formed in deep sandy deposits and have a sandy subsoil and surface layer.

Permeability is very rapid, the available water capacity is very low, and natural fertility is low. Surface runoff is very slow to medium. Organic-matter content is low.

These soils are not suited to intensive farming. Droughtiness, low natural fertility, and a moderate to severe hazard of erosion are the main limitations. To control soil blowing vegetative cover is needed. Beachgrass or other suitable plants are required to stabilize open and eroded areas.

Capability unit VIIIs-1 (Sa)

This capability unit consists only of Lake beaches, a land type. It consists of sandy, gravelly, and, in places, cobbly soil material. Lake beaches are nearly level to gently sloping and occur on narrow areas. They form the present shoreline of Lake Huron and the St. Clair River.

Permeability is very rapid. The available water capacity and natural fertility are very low. The constant erosion hazard and the coarseness of the soil material very severely limit this mapping unit for farming. It is better suited for recreation and wildlife habitat.

Areas of Lake beaches are continuously changing as the lake and river rise and fall and as waves and currents remove or deposit coarse-textured materials. This erosion and deposition can be reduced by groins, seawalls, and rip-rap.

Predicted Yields

The soils of St. Clair County differ considerably in their productivity. Some soils consistently produce high yields of cultivated crops, but others produce low yields. The average acre yields of the principal crops for the soils of this county are given in table 2. These yields are shown for two levels of management, common, or prevailing, and improved.

The A columns of table 2 give the average yields for the main crops grown under prevailing management. Under prevailing management (1) some legumes and grasses are used in the crop rotation; (2) the suitability of the rotation for the soil generally is given little consideration; (3) barnyard manure that is produced on the farm is returned to the soil; (4) lime is applied, but not always according to crop needs or soil tests; (5) some fertilizer is applied; (6) poorly drained areas are often worked when wet, and many times only a partial crop is harvested; (7) erosion control and other good soil management practices are not used to the fullest extent.

The B columns show the average yields for crops produced under improved management. Improved management includes most of the following practices: (1) the crop rotation is adapted to the soil, and a proper proportion of row crops to legume and grass crops is used; (2) the rotation is supplemented by the conservation measures needed to control wind and water erosion, such as contour tillage, stripcropping, minimum tillage, and use of cover crops; (3) the quantity of lime applied is determined by soil tests; (4) fertilizers are applied according to the crop needs and soil tests; (5) adequate artificial drainage systems are installed and maintained in soils that have excess water; (6) adapted and high quality varieties of plants and seeds are used; (7) control of weeds, disease, and insects is practiced; (8) tillage and harvesting operations are performed according to the needs of the crop and the condition of the soil; and (9) green manure, crop residues, and barnyard manure are returned to the soil to improve tilth, supply organic matter, and control erosion.

The crop yields listed are the average of those expected over a period of several years under the two defined levels of management. The yields under improved management are not the maximum obtainable. Under favorable combinations of soil management and weather, the yields could be higher. Irrigation is not considered a part of improved management, since this practice is limited mainly to the production of truck and fruit crops. These yields are predictions of comparative productivity of the soils in St. Clair County.

TABLE 2.—*Predicted average acre yields under two levels of management*

[Yields in columns A are those expected under common management; those in columns B can be expected under improved management. Dashes indicate soil is not suited to the crop, or that the crop ordinarily is not grown]

Soil [1]	Corn (grain)		Corn (silage)		Oats		Wheat		White beans		Soy-beans		Sugar beets		Alfalfa hay		Mixed hay	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Allendale loamy fine sand, 0 to 3 percent slopes	33	63	6	11	32	52	20	34	----	----	18	26	----	----	1.5	2.6	1.3	2.1
Allendale-Hoytville complex, 0 to 6 percent slopes	40	70	7	13	36	59	28	40	15	32	17	28	10	17	1.5	2.8	1.6	2.5
Allendale-Latty complex, 0 to 3 percent slopes	40	70	7	13	36	56	25	37	15	32	17	29	----	----	1.5	2.8	1.4	2.5
Allendale-Lenawee-Toledo complex, 0 to 3 percent slopes	45	75	8	14	39	66	27	41	17	34	18	30	12	18	2.1	3.3	1.8	2.6
Alluvial land	62	90	11	16	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Avoca loamy sand, 0 to 3 percent slopes	40	70	7	13	32	55	28	35	12	30	17	32	----	----	1.7	3.0	1.5	2.3
Bach very fine sandy loam	52	80	9	15	40	75	36	45	10	22	22	35	10	15	2.1	3.3	1.7	2.5
Blount loam, 0 to 2 percent slopes	62	90	11	16	45	75	30	45	17	30	20	35	11	19	2.0	4.0	1.8	2.7
Blount loam, 2 to 6 percent slopes	55	85	10	15	40	70	32	45	17	30	20	33	10	18	2.7	4.0	1.8	2.7
Boyer loamy sand, 2 to 6 percent slopes	30	60	5	11	30	55	25	35	15	24	16	24	----	----	1.5	2.6	1.2	2.0
Chelsea-Croswell sands, 0 to 6 percent slopes	18	40	3	7	21	40	17	25	10	20	12	22	----	----	1.3	2.1	1.1	1.8
Conover loam, 0 to 2 percent slopes	53	90	10	16	40	80	31	50	20	32	20	30	12	19	2.3	4.0	2.0	2.8
Conover loam, 2 to 6 percent slopes	50	90	9	16	40	75	28	45	18	30	20	33	11	18	2.7	4.0	1.9	2.7
Conover-Parkhill loams, 0 to 2 percent slopes	55	93	10	17	43	80	31	48	20	31	23	38	13	20	2.4	4.0	2.0	2.9
Corunna sandy loam	48	85	9	15	45	80	28	45	16	33	22	33	----	----	2.1	3.3	1.7	2.5
Croswell-Lamson complex, 0 to 6 percent slopes	34	60	6	11	33	55	27	35	13	28	17	29	10	15	1.7	3.0	1.4	2.2
Deford fine sand	30	40	5	7	22	45	15	26	10	28	20	30	----	----	1.5	2.5	1.5	2.3
Gilford sandy loam	50	80	9	15	35	60	20	35	15	30	20	30	10	15	2.1	3.0	1.5	2.5
Houghton muck	60	90	11	16	----	----	----	----	----	----	28	40	12	16	----	----	----	----
Jeddo silt loam	50	95	9	17	50	75	27	50	15	30	20	35	13	19	2.4	3.7	2.0	2.8
Lamson fine sandy loam	52	85	9	15	45	70	38	45	15	35	22	35	10	15	2.0	3.5	1.7	2.5
Latty silty clay loam	35	70	6	13	40	60	29	40	15	32	16	32	----	----	1.5	3.0	1.5	2.8
Latty complex, 0 to 3 percent slopes	45	80	8	15	45	65	30	45	12	28	18	28	----	----	2.1	3.0	1.6	2.3
Latty complex, sandy subsoil variant, 0 to 3 percent slopes	45	80	8	15	45	65	30	45	12	28	18	28	----	----	2.1	3.0	1.6	2.3
Lenawee silt loam	50	90	9	16	45	80	30	45	18	35	20	35	13	19	2.4	3.7	2.0	2.8
Lenawee complex, 0 to 3 percent slopes	50	90	9	16	45	80	30	45	18	35	20	35	13	19	2.4	3.7	2.0	2.8
Londo loam, 0 to 2 percent slopes	60	95	11	17	50	80	35	55	17	30	20	33	13	20	2.7	4.0	1.9	3.0
Londo loam, 2 to 6 percent slopes	55	90	10	16	50	78	32	50	17	30	20	33	12	19	2.7	4.0	1.8	2.9
Londo complex, 0 to 2 percent slopes	50	80	9	15	41	68	32	45	15	30	19	33	13	20	2.2	3.5	1.7	3.2
Metamora sandy loam, 0 to 2 percent slopes	45	65	8	12	40	60	25	40	17	25	25	35	9	14	2.1	3.0	1.7	2.5
Metamora sandy loam, 2 to 6 percent slopes	40	60	7	11	35	55	23	37	15	22	23	32	9	14	2.0	3.0	1.5	2.3
Metamora-Parkhill complex, 0 to 2 percent slopes	52	80	9	15	43	70	28	43	19	28	25	38	12	17	2.3	3.5	1.9	2.7
Metea loamy sand, 2 to 6 percent slopes	30	65	5	12	35	50	20	35	15	28	16	28	----	----	1.5	2.6	1.2	2.0
Miami loam, 6 to 12 percent slopes	50	80	9	15	35	65	25	35	10	20	14	24	----	----	2.0	3.5	1.2	2.0
Miami-Dighton sandy loams, 0 to 2 percent slopes	50	90	9	16	45	70	35	45	20	35	25	35	11	18	3.0	4.5	1.8	2.6
Miami-Dighton sandy loams, 2 to 6 percent slopes	45	85	8	15	40	65	30	45	18	32	20	30	10	17	2.5	4.0	1.6	2.4
Minoa fine sandy loam, 0 to 2 percent slopes	41	85	7	15	40	65	26	45	16	25	20	28	9	14	2.0	3.0	1.6	2.7
Minoa fine sandy loam, 2 to 6 percent slopes	40	80	7	15	40	65	25	45	16	25	20	28	9	14	2.0	3.0	1.6	2.6
Minoa fine sandy loam, clay substratum, 0 to 3 percent slopes	45	85	8	15	45	70	25	45	16	25	20	26	8	13	1.8	2.9	1.5	2.5
Minoa-Lamson complex, 0 to 3 percent slopes	49	85	9	15	45	70	32	45	16	30	21	31	9	14	1.9	3.2	1.6	2.5
Morley loam, 6 to 12 percent slopes, eroded	50	80	9	15	38	60	30	40	12	22	14	24	----	----	2.0	3.2	1.2	2.0
Morley loam, 12 to 18 percent slopes, eroded	----	----	----	----	35	45	20	30	----	----	----	----	----	----	1.8	3.0	1.0	1.8
Nappanee-Hoytville complex, 0 to 3 percent slopes	50	80	9	15	40	65	30	45	14	30	20	30	10	17	2.0	3.5	1.7	2.6
Otisco loamy sand, 0 to 2 percent slopes	30	65	5	12	30	55	25	35	12	28	18	26	----	----	1.5	2.6	1.1	2.1
Palms muck	60	90	11	16	----	----	35	45	25	35	28	40	12	16	----	----	----	----
Parkhill loam	59	95	11	17	45	80	30	45	20	30	25	40	14	20	2.5	4.5	2.0	2.9

See footnote at end of table.

TABLE 2.—*Predicted average acre yields under two levels of management*—Continued

Soil[1]	Corn (grain)		Corn (silage)		Oats		Wheat		White beans		Soy-beans		Sugar beets		Alfalfa hay		Mixed hay	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Paulding clay	25	60	5	11	25	40	25	35	----	----	8	28	----	----	1. 2	2. 6	1. 0	2. 2
Pert loam, 2 to 6 percent slopes	55	85	10	15	45	75	30	45	20	30	25	45	12	19	2. 3	4. 0	2. 1	2. 9
Pert-Sims loams, 0 to 6 percent slopes	50	85	9	15	48	75	29	48	18	30	23	40	13	19	2. 4	3. 9	2. 1	2. 9
Pinconning mucky fine sand	20	45	4	8	20	40	12	25	10	22	10	25	----	----	1. 1	2. 2	1. 0	1. 8
Rousseau fine sand, 0 to 6 percent slopes	20	45	4	8	18	35	18	26	10	19	12	20	----	----	1. 4	2. 3	1. 1	1. 8
Rousseau fine sand, 6 to 12 percent slopes	16	40	3	7	13	30	15	21	8	17	9	18	----	----	0. 9	1. 9	0. 8	1. 3
Sanilac very fine sandy loam, 0 to 2 percent slopes	40	85	7	15	40	70	20	40	16	33	22	35	----	----	1. 5	3. 0	1. 4	2. 2
Sims loam	55	90	10	16	45	75	30	50	15	30	20	35	13	19	2. 4	3. 7	2. 0	2. 8
Spinks loamy sand, 0 to 2 percent slopes	30	60	5	11	30	50	20	30	14	22	16	24	----	----	1. 5	2. 5	1. 2	1. 8
Spinks loamy sand, 2 to 6 percent slopes	26	55	5	10	30	50	18	30	12	22	14	24	----	----	1. 3	2. 3	1. 0	1. 6
Spinks loamy sand, loamy substratum, 0 to 6 percent slopes	30	55	5	10	30	50	20	30	14	22	16	24	----	----	1. 5	2. 5	1. 2	1. 8
Thomas complex	50	90	9	16	45	80	30	45	18	35	20	35	13	19	2. 4	3. 7	2. 0	2. 8
Toledo silty clay loam	55	80	10	15	40	65	32	45	15	32	16	30	10	17	2. 0	3. 5	2. 0	2. 8
Wainola loamy fine sand, 0 to 2 percent slopes	37	75	7	14	40	82	32	43	15	30	17	30	----	----	2. 0	3. 0	1. 4	2. 0
Wainola-Deford fine sands, 0 to 2 percent slopes	34	58	6	11	31	64	24	35	13	24	19	30	----	----	1. 8	2. 8	1. 5	2. 2
Wainola-Tobico complex, 0 to 3 percent slopes	34	58	6	11	31	64	24	35	13	24	19	30	----	----	1. 8	2. 8	1. 5	2. 2
Wasepi sandy loam, 0 to 2 percent slopes	40	70	7	13	35	60	30	40	10	28	20	30	----	----	1. 8	3. 0	1. 3	2. 3
Wasepi-Boyer complex, loamy substratum, 0 to 6 percent slopes	35	65	6	12	33	58	28	38	13	26	18	27	----	----	1. 7	2. 8	1. 3	2. 2
Wasepi sandy loam, clay subsoil variant, 0 to 3 percent slopes	35	60	6	11	30	50	29	35	12	28	18	28	----	----	1. 5	2. 6	1. 2	2. 1

[1] The land types Borrow pits, Lake beaches, Made land, and Rough broken land and the soils Eastport sand, 0 to 6 percent slopes, and Eastport sand, 6 to 18 percent slopes, are not listed in this table. These mapping units are not used for crops.

Woodland[3]

St. Clair County was covered almost entirely by forest when it was first settled. Mixed hardwoods intermingled with white pine and hemlock grew on the uplands, and swamp hardwoods and conifers grew on the lowlands. A few relatively pure stands of white pine existed on soils of the uplands in the northern and eastern parts of the county. Nearly all of the original forest has been cut in the county. In wooded areas the well-drained sandy soils are covered by second-growth mixed hardwoods, and some areas have been planted to pines. Wooded areas of the better drained, medium-textured soils are predominantly covered by mixed stands of oak, hickory, maple, ash, cherry, beech, basswood, and elm. The vegetation on the poorly drained, medium- to fine-textured soils that are now timbered is predominantly elm and red maple with some white ash, basswood, and swamp white oak. Aspen, white birch, elm, and red maple are dominant trees on poorly drained, coarse-textured soils and organic soils. About 12 percent of the county now is in woodland.

Woodland groups

The soils of St. Clair County have been placed in nine woodland suitability groups to assist owners in planning the use of their soils for wood crops. Since the woodland groups are established on a statewide basis, not all groups are present or described in St. Clair County. Alluvial land, Borrow pits, Lake beaches, Made land, and Rough broken land are not placed in a woodland suitability group. Woodland management of these land types requires specific recommendations from the local soil conservationists or forestry technicians.

Each woodland suitability group consists of soils that are similar in productivity, in management problems and response to management, and in requirements for conservation practices. The factors considered in placing each soil in a woodland group include potential productivity, which is expressed as site index; species to favor in management of existing stands; trees preferred for planting; and soil-related hazards and major limitations to be considered in management.

Productivity.—The potential productivity of a soil for a given species is commonly expressed as site index. It is the height in feet that the dominant trees of a given species, growing on a specified soil, will reach in a natural, unmanaged stand in a stated number of years. On the basis of the site index, rates of growth can be calculated.

The oaks have been grouped as follows:

Upland oak: White oak, *Quercus alba;* bur oak, *Quercus macrocarpa;* black oak, *Quercus velutina;* northern red oak, *Quercus rubra.*

[3] By JACQUES J. PINKARD, woodland conservationist, Soil Conservation Service.

Wetland oak: Swamp white oak, *Quercus bicolor;* chestnut oak, *Quercus montana;* pin oak, *Quercus palustris.*

Species priority.—Species to favor in management of existing stands for each woodland suitability group are listed in order of priority, the first species listed having the highest priority. The species are selected on the basis of their adaptability or tolerance and their productivity and commercial value. The first species should be given the most consideration when improvement cuttings are made. Trees preferred for planting are listed in order of the most suitable trees for open-field and woodland interplanting on the soils in each woodland group. Other than the trees listed for planting, the ones most likely to be worth growing are those in natural stands. Trees are not commonly planted on somewhat poorly drained and poorly drained soils unless the soils have been artificially drained.

Seedling mortality.—Unfavorable soil characteristics prevent the survival of some healthy seedlings, whether naturally occurring or planted. A high water table, extreme droughtiness, and high soil temperature are some of the soil characteristics that cause seedlings to die. A seedling mortality rating of *slight* indicates that ordinary losses from these causes are not more than 25 percent of the planted stock. A rating of *moderate* indicates that expected losses are between 25 to 50 percent of the planted stock. A rating of *severe* indicates that more than 50 percent of the trees in a planting are likely to die.

Plant competition.—When a site has been disturbed by fire, cutting, or other factors, and the soil is fertile and moist, undesirable species of brush, trees, and other plants may invade the site. A rating of *slight* indicates that invasion by undesirable trees does not impede the establishment or growth of natural or planted stands of the preferred kind of trees. A rating of moderate indicates that competing plants generally do not prevent development of adequate stands of desirable kinds of trees. A rating of *severe* indicates that competing plants can prevent establishment of a desirable stand unless intensive site preparation and maintenance are used to control these undesirable plants.

Equipment limitations.—Some soil characteristics restrict or make impossible the use of equipment commonly used in woodland management and harvesting. In St. Clair County, soil characteristics that have the most limiting effects are drainage, depth to the water table, and texture of the surface layer. An equipment limitation of *slight* indicates that any type of equipment can be used at any time during the year. A rating of *moderate* indicates that not all types of equipment can be used or that the use of heavy equipment is restricted for as long as 3 months of the year. A rating of *severe* indicates that special equipment is needed and that its use is restricted for more than 3 months of the year.

Windthrow hazard.—This refers to the danger of trees being blown over by wind. It is an evaluation of soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. The hazard is *slight* if trees are not expected to be blown down in commonly occurring winds; *moderate* if some trees are blown down during periods of excessive soil wetness and strong wind; and *severe* if many trees are blown down during periods of excessive soil wetness and moderate or strong wind.

Erosion hazard.—This refers to the potential hazard of soil losses by wind or water in well-managed woodland. Considered in the ratings are texture of the surface layer and slope. The hazard is *slight* if expected soil losses are small; *moderate* if some soil losses are expected and care is needed during logging and construction to reduce the risk of erosion; and *severe* if special methods of operation are necessary for preventing excessive soil losses.

Each woodland group is identified by a three-part symbol, such as 2o1, 3s3, or 4w1(*3*). The first part of the symbol, always a number, indicates relative potential productivity of the soils in the group: 1 is *very high;* 2 is *high;* 3 is *moderately high;* 4 is *moderate;* and 5 is *low.* These ratings are based on field determinations of average site index. The second part of the symbol identifying a woodland group is a small letter. This letter indicates an important soil property that imposes a moderate or severe hazard or limitation in managing the soils of the group for wood crops. A letter *c* shows that the main limitation is the kind or amount of clay in the upper part of the soils in the group; *o* shows that the soils have few limitations that restrict their use for trees; *s* shows that the soils are sandy and dry, have low available water capacity, and generally have a low supply of plant nutrients; and *w* shows that water in or on the soils, either seasonally or year round, is the chief limitation. The last part of the symbol, another common number, identifies the specific woodland suitability group.

Woodland group 2o1

This group consists of well-drained soils that have a generally loamy surface layer and subsoil. These soils are highly fertile and have moderate to high available water capacity. Slopes range from 0 to 12 percent.

These soils are well suited to hardwoods. The site index for upland oaks is 75 to 85. The expected yield is from 275 to 325 or more board feet per acre per year (International Rule, 1/4 inch) at 70 years of age. Competition from other plants is moderate on these soils. All other limitations are slight.

Species to favor in existing stands are red oak, white oak, white ash, sugar maple, and black cherry. Trees preferred for planting are black walnut, yellow-poplar, and white pine.

Woodland group 3c1

This group consists of well drained and moderately well drained soils that have a loamy surface layer and a loamy to clayey subsoil. These soils have medium fertility and high available water capacity. Slopes range from 6 to 18 percent.

These soils are fairly well suited to hardwoods. The site index for upland oaks is 65 to 75. The expected yield is from 200 to 275 or more board feet per acre per year (International Rule, 1/4 inch) at 80 years of age. The erosion hazard and plant competition are moderate on these soils. All other limitations are slight.

Species to favor in existing stands are red oak, white oak, sugar maple, basswood, and white ash. Trees preferred for planting are white spruce, Norway spruce, and white pine.

Woodland group 3s1

This group consists of well-drained soils that have a sandy surface layer and a sandy to loamy subsoil. These soils have low fertility and low available water capacity. Slopes range from 0 to 12 percent.

These soils are fairly well suited to hardwoods and are well suited to pines. The site index for upland oaks is 65 to 75. The expected yield is from 200 to 275 or more board feet per acre per year (International Rule, 1/4 inch) at 80 years of age. The site index for red pine is 65 to 75. The expected yield is 325 or more board feet per acre per year (International Rule, 1/4 inch) at 60 years of age. All limitations are slight.

Species to favor in existing stands are red oak, white oak, basswood, aspen, and white pine. Trees preferred for planting are white pine, red pine, and white spruce (fig. 12).

Woodland group 3s3

This group consists of well drained and moderately well drained soils that have a sandy surface layer and subsoil. These soils have low fertility and low to very low available water capacity. Slopes range from 0 to 18 percent.

These soils are fairly well suited to pines. The site index for red pine is 55 to 65. The expected yield is from 275 to 325 or more board feet per acre per year (International Rule, 1/4 inch) at 70 years of age. Seedling mortality is moderate on these soils. All other limitations are slight.

Species to favor in existing stands are red pine, white pine, jack pine, aspen, and paper birch. Trees preferred for planting are red pine, white pine, and jack pine.

Woodland group 3w1

This group consists of somewhat poorly drained soils that have a loamy surface layer and generally a loamy to clayey subsoil. These soils range from medium to high in fertility and from moderate to high in available water capacity. They have a seasonal high water table. Slopes range from 0 to 6 percent.

These soils are fairly well suited to hardwoods. The site index for upland oaks is 65 to 75. The expected yield is from 200 to 275 or more board feet per acre per year (International Rule, 1/4 inch) at 80 years of age. The equipment limitation is moderate, and plant competition generally is severe. All other limitations are slight.

***Figure 12.*—Christmas trees on Rousseau fine sand, 0 to 6 percent slopes, which is in woodland group 3s1.**

Species to favor in existing stands are white ash, red oak, white oak, basswood, and cottonwood. Trees preferred for planting are white spruce, white pine, northern white-cedar, and Norway spruce.

Woodland group 3w2

This group consists of somewhat poorly drained soils that have a sandy to loamy surface layer and subsoil. These soils have low to medium fertility, low to moderate available water capacity, and a seasonal high water table. Slopes range from 0 to 6 percent.

These soils are fairly well suited to hardwoods. The site index for aspen is 55 to 65. The expected yield is from 125 to 200 board feet per acre per year (International Rule, 1/4 inch) at 50 years of age. The equipment limitation and competition from other plants are moderate on these soils. All other limitations are slight.

Species to favor in existing stands are white ash, red maple, silver maple, aspen, and swamp white oak. Trees preferred for planting are white spruce, Norway spruce, northern white-cedar, and white pine.

Woodland group 3w3

This group consists of poorly drained and very poorly drained soils that have a loamy surface layer and a loamy to clayey subsoil. These soils are highly fertile and have high available water capacity. They have a seasonal high water table. Slopes range from 0 to 3 percent.

These soils are fairly well suited to hardwoods. The site index for lowland hardwoods is 65 to 75. The expected yield is from 285 to 320 board feet per acre per year (International Rule, 1/4 inch) at 70 years of age. The erosion hazard is slight on these soils. The equipment limitation and seedling mortality are severe. Competition from other plants is severe on these soils. The windthrow hazard is moderate.

Species to favor in existing stands are red maple, silver maple, basswood, pin oak, bur oak, white ash, and swamp white oak. In undrained areas, natural regeneration is better than planting on these soils. In drained areas, trees preferred for planting are white spruce, Norway spruce, white pine, and northern white-cedar.

Woodland group 4w1

This group consists of poorly drained or very poorly drained soils that have a sandy to clayey surface layer and subsoil. These soils have variable fertility and available water capacity. They have a seasonal high water table. Slopes range from 0 to 3 percent.

These soils are poorly suited to hardwoods. The site index for lowland hardwoods is 55 to 65. The expected yield is from 125 to 200 board feet per acre per year (International Rule, 1/4 inch) at 80 years of age. The erosion hazard is slight. The equipment limitation, seedling mortality, and competition from other plants are all severe. The hazard of windthrow is moderate.

Species to favor in existing stands are white ash, red maple, silver maple, basswood, aspen, pin oak, and swamp white oak. Planting trees on these soils is not recommended without drainage. In drained areas, trees preferred for planting are white spruce, Norway spruce, white pine, and northern white-cedar.

Woodland group -w1

This group consists of very poorly drained, organic soils. These soils have low fertility and very high available water capacity. The water table is at or near the surface of these soils during most of the year. Slopes are less than 2 percent.

Timber production on these soils is extremely variable. No data are available on the potential productivity. For this reason, the number normally used to indicate potential productivity is missing in the symbol for this woodland group. The erosion hazard is slight. All other limitations are severe.

Species to favor in existing stands are red maple and aspen. Trees preferred for the planting of windbreaks only are Austrian pine, white pine, and Scotch pine.

Wildlife [4]

Table 3 rates the soils according to their suitability for elements of wildlife habitat and for general kinds of wildlife. A rating of *well suited* means that the soil is relatively free of limitations or that the limitations are easily overcome. *Suited* means that the limitations need to be recognized, but that they can be overcome by good management and careful design. *Poorly suited* means that limitations are severe enough to make use of the soil questionable for wildlife habitat. *Not suited* means that extreme measures are needed to overcome the limitations and that usage generally is not practical. The eight elements of wildlife habitat are discussed briefly in the following paragraphs.

Grain and seed crops.—Among these crops are corn, wheat, oats, barley, rye, buckwheat, millet, sorghum, soybeans, and sunflowers.

Grass and legumes.—These are planted grasses and legumes commonly used for forage. Examples are bromegrass, fescue, timothy, redtop, trefoil, orchardgrass, reed canarygrass, clover, alfalfa, and sudangrass.

Wild herbaceous upland plants.—In this group are native annuals or other herbaceous plants that commonly grow in upland areas. Among them are strawberries, dandelions, goldenrod, wild oats, nightshade, ragweed, lambsquarters, and native grasses.

Hardwood plants.—These plants are hardwood trees and shrubs that grow vigorously and produce sprouts, fruits, or seeds that wildlife browse on. These woody plants either grow naturally or are planted. Examples are maple, beech, oak, poplar, birch, dogwood, willow, hawthorn, viburnum, wintergreen, raspberries, blackberries, cherries, grapes, and blueberries.

Coniferous plants.—Examples of native or planted coniferous trees and shrubs are pine, spruce, white-cedar, hemlock, balsam fir, yew, larch, and juniper.

Wetland food and cover plants.—These are plants that grow in moist or wet sites and that provide food and cover for waterfowl and furbearing animals. Examples are cattails, sedges, bulrushes, smartweed, wild millet, water plantain, wildrice, arrowhead, pondweed, pickerelweed, wildcelery, duckweed, and burreed.

[4] By CHARLES M. SMITH, biologist, Soil Conservation Service.

Shallow-water developments. These are impoundments of shallow water in marshy areas and stream channels. They consist of low dikes, nearly level ditches, dugouts, and devices to maintain water at a depth suitable for wetland wildlife.

Excavated ponds.—Migrating waterfowl are especially attracted to excavated, or dug-out, ponds. Such ponds should have an independent source of water. They should not depend on runoff from surrounding areas, though they benefit from runoff that is not excessive.

The ratings shown in table 3 under the heading "Kinds of wildlife" apply to wildlife in general and not to a specific species. Not considered, therefore, are present land use, existing vegetation, and the extent of artificial drainage provided, because these factors are subject to change. Also, consideration is not given to the ability of wildlife to move from place to place.

A rating of *well suited* or *suited* indicates that the soil can be managed most practically and with the best chance of success. A rating of *poorly suited* does not necessarily mean that a soil cannot be managed for wildlife, but it does show that a high level of management is required to improve the soil. Following are descriptions of the kinds of wildlife.

Openland wildlife.—This kind of wildlife is made up of birds and mammals that normally frequent cropland, pasture, meadow, and areas overgrown with grasses, herbs, and shrubs. Examples are quail, pheasant, meadowlark, field sparrow, red fox, cottontail rabbit, woodchuck, and hawk.

Woodland wildlife.—These birds and mannals normally frequent wooded areas consisting of hardwood trees, coniferous trees, shrubs, or mixed stands of such plants. Among them are squirrel, raccoon, ruffed grouse, woodcock, woodpecker, warbler, nuthatch, deer, gray fox, and owl.

Wetland wildlife.—In this group are birds and mammals that normally frequent such wet areas as ponds, marshes, and swamps. Examples are muskrat, duck, geese, heron, rail, kingfisher, mink, crane, and bittern.

Engineering Uses of the Soils

This section describes the properties of the soils that are important to engineering. Some soil properties are of special interest to the engineer because they affect the construction and maintenance of roads, airports, pipelines, building foundations, structures for water storage, structures for controlling erosion, drainage systems, and sewage disposal systems. Among the soil properties most important to the engineer are permeability to water, shear strength, compaction characteristics, drainage, shrink-swell characteristics, grain size, plasticity, and pH. Depth to the water table, depth to bedrock, and topography are also important.

Information concerning these and related soil properties is given in tables 4, 5 and 6. The estimates and interpretations of soil properties in these tables can be used in—

1. Planning and designing agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soil.

TABLE 3.—*Suitability of soils for elements*

[Alluvial land (Au), Borrow pits (Bp), Lake Beaches (La), Made land (Md), and Rough broken

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood plants
Allendale: AeA, AhB, AlA, AtA. For Hoytville part of AhB, see Hoytville series; for Latty part of AlA, see Latty series; for Lenawee and Toledo parts of AtA, see Lenawee and Toledo series.	Not suited	Poorly suited	Poorly suited	Poorly suited
Avoca: AvA	Not suited	Poorly suited	Poorly suited	Poorly suited
Bach: Bc	Not suited	Poorly suited	Poorly suited	Suited
Blount: BlA, BlB	Suited	Suited	Well suited	Well suited
Boyer: BrB	Suited	Well suited	Well suited	Suited
Chelsea: CcB. For Croswell part, see Croswell series.	Not suited	Poorly suited	Poorly suited	Not suited
Conover: CvA, CvB, CwA. For Parkhill part of CwA, see Parkhill series.	Suited	Suited	Well suited	Well suited
Corunna: Cx	Not suited	Poorly suited	Poorly suited	Suited
Croswell: CyB. For Lamson part see Lamson series.	Not suited	Poorly suited	Poorly suited	Poorly suited
Deford: De	Not suited	Poorly suited	Poorly suited	Poorly suited
Dighton. Mapped only with Miami soils.	Well suited	Well suited	Well suited	Well suited
Eastport: EaB, EaC	Not suited	Not suited	Poorly suited	Poorly suited
Gilford: Gd	Not suited	Suited	Suited	Suited
Houghton: Ha	Not suited	Poorly suited	Not suited	Not suited
Hoytville. Mapped only with Allendale and Nappanee soils.	Not suited	Poorly suited	Poorly suited	Well suited
Jeddo: Ja	Not suited	Poorly suited	Poorly suited	Suited
Lamson: Ld	Not suited	Poorly suited	Poorly suited	Well suited
Latty: Le, LhA. Somewhat poor drainage in 40 to 50 percent of LhA.	Not suited	Poorly suited	Poorly suited	Well suited
Latty sandy subsoil variant: LlA	Poorly suited	Suited	Suited	Well suited
Lenawee: Lm, LnA. Somewhat poor drainage in 30 to 40 percent of LnA.	Not suited	Poorly suited	Poorly suited	Well suited
Londo: LoA, LoB, LpA. Surface layer of loamy sand, 10 to 17 inches thick, in 40 to 70 percent of LpA.	Suited	Suited	Well suited	Suited
Metamora: MeA, MeB, MhA. For Parkhill part of MhA, see Parkhill series.	Suited	Suited	Well suited	Well suited
Metea: MlB	Suited	Suited	Suited	Well suited
Miami: MmC, MnA, MnB. For Dighton part of MnA and MnB, see Dighton series.	Well suited	Well suited	Well suited	Well suited

of wildlife habitat and kinds of wildlife

land (Ro) are not listed in this table. They are so variable that onsite investigation is needed.]

Elements of wildlife habitat—Continued				Kinds of wildlife that find habitat in—		
Coniferous plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland	Woodland	Wetland
Poorly suited	Poorly suited	Suited	Suited	Poorly suited	Not suited	Poorly suited.
Poorly suited	Poorly suited	Suited	Suited	Poorly suited	Not suited	Poorly suited.
Well suited	Well suited	Well suited	Well suited	Poorly suited	Suited	Suited.
Suited	Suited	Suited	Suited	Well suited	Suited	Well suited.
Poorly suited	Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.
Not suited	Not suited	Not suited	Not suited	Not suited	Not suited	Not suited.
Suited	Suited	Suited	Suited	Well suited	Suited	Suited.
Well suited	Well suited	Well suited	Well suited	Poorly suited	Suited	Suited.
Well suited	Not suited	Not suited	Not suited	Poorly suited	Poorly suited	Not suited.
Well suited	Not suited	Well suited	Well suited	Poorly suited	Poorly suited	Poorly suited.
Poorly suited	Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.
Suited	Not suited	Not suited	Not suited	Poorly suited	Poorly suited	Well suited.
Suited	Well suited	Well suited	Well suited	Suited	Suited	Well suited.
Not suited	Well suited	Well suited	Well suited	Not suited	Not suited	Well suited.
Well suited	Suited	Well suited	Well suited	Poorly suited	Well suited	Well suited.
Well suited	Well suited	Well suited	Well suited	Poorly suited	Suited	Well suited.
Well suited	Well suited	Well suited	Well suited	Poorly suited	Well suited	Well suited.
Well suited	Suited	Well suited	Well suited	Poorly suited	Well suited	Well suited.
Suited	Suited	Suited	Suited	Suited	Well suited	Suited.
Well suited	Well suited	Well suited	Well suited	Poorly suited	Well suited	Well suited.
Suited	Suited	Suited	Suited	Well suited	Suited	Suited.
Suited	Suited	Suited	Suited	Well suited	Suited	Suited.
Poorly suited	Not suited	Not suited	Not suited	Suited	Suited	Not suited.
Poorly suited	Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.

TABLE 3.—*Suitability of soils for elements of*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood plants
Minoa: MoA, MoB, MsA For Lamson part of MsA, see Lamson series.	Suited	Suited	Well suited	Well suited
Minoa, clay substratum: MrA	Suited	Suited	Well suited	Well suited
Morley:				
MtC2	Suited	Well suited	Well suited	Well suited
MtD2	Poorly suited	Suited	Well suited	Well suited
Nappanee: NhA For Hoytville part of NhA, see Hoytville series.	Suited	Suited	Suited	Well suited
Otisco: OaA	Not suited	Poorly suited	Poorly suited	Poorly suited
Palms: Pa	Not suited	Poorly suited	Not suited	Not suited
Parkhill: Pc	Not suited	Poorly suited	Poorly suited	Well suited
Paulding: Pd	Not suited	Poorly suited	Poorly suited	Well suited
Pert: PeB, PlB For Sims part of PlB, see Sims series.	Suited	Suited	Suited	Suited
Pinconning: Pn	Not suited	Poorly suited	Poorly suited	Poorly suited
Rousseau: RuB, RuC	Not suited	Poorly suited	Poorly suited	Poorly suited
Sanilac: SaA	Suited	Suited	Well suited	Suited
Sims: Sm	Not suited	Poorly suited	Poorly suited	Well suited
Spinks: SpA, SpB	Suited	Well suited	Well suited	Well suited
Spinks, loamy substratum: SsB	Suited	Suited	Well suited	Suited
Thomas: Th Calcareous, clayey soils in 40 to 50 percent of this mapping unit.	Not suited	Poorly suited	Poorly suited	Well suited
Tobico Mapped only with Wainola soils.	Not suited	Poorly suited	Poorly suited	Not suited
Toledo: To	Not suited	Poorly suited	Poorly suited	Well suited
Wainola: WaA, WdA, WnA For Deford part of WdA, see Deford series; for Tobico part of WnA, see Tobico series.	Suited	Suited	Suited	Well suited
Wasepi: WoA	Suited	Suited	Well suited	Well suited
Wasepi, clay subsoil variant: WsA	Suited	Suited	Well suited	Well suited
Wasepi-Boyer complex, loamy substratum: WpB	Well suited to suited.	Well suited to suited.	Well suited	Well suited

wildlife habitat and kinds of wildlife—Continued

Elements of wildlife habitat—Continued				Kinds of wildlife that find habitat in—		
Coniferous plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland	Woodland	Wetland
Suited	Suited	Suited	Suited	Well suited	Suited	Suited.
Suited	Suited	Suited	Suited	Well suited	Suited	Suited.
Poorly suited Poorly suited	Not suited Not suited	Not suited Not suited	Not suited Not suited	Well suited Suited	Well suited Suited	Not suited. Not suited.
Suited	Suited	Suited	Suited	Well suited	Suited	Suited.
Suited	Poorly suited	Suited	Suited	Poorly suited	Not suited	Poorly suited.
Not suited	Well suited	Well suited	Well suited	Not suited	Not suited	Well suited.
Well suited	Well suited	Well suited	Well suited	Poorly suited	Well suited	Well suited.
Well suited	Suited	Well suited	Well suited	Poorly suited	Well suited	Well suited.
Poorly suited	Poorly suited	Suited	Suited	Suited	Poorly suited	Poorly suited.
Well suited	Not suited	Well suited	Well suited	Poorly suited	Poorly suited	Poorly suited.
Well suited	Not suited	Not suited	Not suited	Poorly suited	Poorly suited	Not suited.
Suited	Suited	Suited	Suited	Well suited	Suited	Suited.
Well suited	Well suited	Well suited	Well suited	Suited	Suited	Well suited.
Suited	Not suited	Not suited	Not suited	Well suited	Well suited	Not suited.
Poorly suited	Suited	Suited	Suited	Well suited	Suited	Suited.
Well suited	Well suited	Well suited	Well suited	Poorly suited	Well suited	Well suited.
Well suited	Not suited	Well suited	Well suited	Poorly suited	Well suited	Poorly suited.
Well suited	Suited	Well suited	Well suited	Poorly suited	Well suited	Well suited.
Suited	Suited	Suited	Suited	Well suited	Suited	Suited.
Suited	Suited	Suited	Suited	Well suited	Well suited	Well suited.
Suited	Suited	Suited	Suited	Well suited	Suited	Suited.
Suited to poorly suited.	Suited to not suited.	Suited to not suited.	Suited to not suited.	Well suited	Well suited to suited.	Suited to not suited.

TABLE 4.—*Estimated engi-*

[Alluvial land (Au), Borrow pits (Bp), Lake beaches (La), Made land (Md), and Rough broken land (Ro) are not listed in this table. They is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this symbol < means less than; the symbol > means more than]

Soil series and map symbols	Depth to seasonal high water table [1]	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	*Inches*			
*Allendale: AeA, AhB, AlA, AtA. For Hoytville part of AhB, see Hoytville series; for Latty part of AlA, see Latty series; for Lenawee and Toledo parts of AtA, see Lenawee and Toledo series.	1-2	0-7	Loamy fine sand	SM	A-2
		7-33	Fine sand and loamy fine sand	SP-SM or SP	A-3
		33-62	Clay	CH	A-7
Avoca: AvA	1-2	0-12	Loamy sand and sand	SM	A-2
		12-33	Fine sand	SP or SP-SM	A-3
		33-54	Clay loam	ML or CL	A-6
Bach: Bc	<1	0-48	Very fine sandy loam	ML	A-4
		48-62	Loamy very fine sand	SM or ML	A-4
Blount: BlA, BlB	1-2	0-9	Loam	ML	A-4
		9-21	Clay loam	CL	A-6
		21-31	Clay	CH	A-7
		31-62	Silty clay loam	CL	A-6
Boyer: BrB	>4	0-22	Loamy sand	SM or SP-SM	A-2
		22-38	Sandy loam and loamy sand	SM	A-2
		38-62	Sand and gravel	SP-SM or SP	A-1
*Chelsea: CcB. For Croswell part of this mapping unit, see Croswell series.	>4	0-36	Sand	SP-SM	A-3
		36-62	Layers of sand and loamy sand	SM and SP-SM	A-2
*Conover: CvA, CvB, CwA. For Parkhill part of CwA, see Parkhill series.	1-2	0-19	Loam	ML	A-4
		19-26	Clay loam	CL	A-6
		26-62	Loam	ML-CL or CL	A-4
Corunna: Cx	<1	0-31	Sandy loam	SM or SC	A-4
		31-56	Loam or clay loam	ML-CL or CL	A-4 or A-6
*Croswell: CyB. For Lamson part of this mapping unit, see Lamson series.	2-3	0-7	Sand	SP-SM	A-3
		7-62	Sand	SP	A-3
Deford: De	<1	0-9	Fine sand	SM	A-2
		9-62	Fine sand and sand	SP-SM	A-3
Dighton. Mapped only with Miami soils.	>3	0-18	Sandy loam	SM	A-2 or A-4
		18-29	Clay loam	CL	A-6
		29-36	Fine sandy loam	SM	A-2 or A-4
		36-55	Stratified fine sand and loamy fine sand.	SM	A-2
		55-64	Sand	SP	A-3
Eastport: EaB, EaC	>4	0-7	Sand	SP-SM	A-3
		7-62	Sand	SP	A-3
Gilford: Gd	<1	0-10	Sandy loam	SM	A-2
		10-27	Sandy loam	SM	A-2
		27-36	Loamy sand	SM	A-2
		36-62	Coarse sand	SP	A-1
Houghton: Ha	0	0-62	Muck	Pt	-------------
Hoytville. Mapped only with Allendale and Nappanee soils.	<1	0-9	Silty clay loam	CL	A-4 or A-6
		9-29	Clay	CH	A-7
		29-62	Clay	CH	A-7
Jeddo: Ja	<1	0-8	Silt loam	ML	A-4
		8-46	Silty clay loam and silty clay	CL or CH	A-6 or A-7
		46-62	Silty clay loam	CL	A-6

neering properties of soils

are so variable that onsite investigation is needed. An asterisk in the first column indicates that at least one mapping unit in this series
reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table. The

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
			Inches per hour	*Inches per inch of soil*	*pH value*	
100	100	15–30	6. 3–20. 0	0. 10	5. 6–6. 0	Low.
100	95–100	0–10	6. 3–20. 0	. 06	5. 6–7. 3	Low.
95–100	90–100	75–95	<0. 06	. 14	[2] 7. 4–8. 0	High.
100	95–100	15–25	6. 3–20. 0	. 10	6. 1–6. 5	Low.
100	95–100	0–10	6. 3–20. 0	. 06	6. 1–7. 8	Low.
90–95	85–95	60–80	0. 2–0. 63	. 18	[2] 7. 8–8. 0	Moderate to low.
100	100	50–65	0. 63–2. 0	. 14	[2] 7. 4–8. 0	Low.
100	95–100	40–60	2. 0–6. 3	. 10	[2] 7. 4–8. 0	Low.
95–100	95–100	55–70	0. 63–2. 0	. 18	5. 1–5. 5	Low.
95–100	95–100	70–80	0. 2–0. 63	. 18	5. 1–6. 0	Moderate.
100	95–100	75–95	0. 06–0. 2	. 16	6. 6–7. 3	High.
90–95	85–95	70–90	0. 2–0. 63	. 16	7. 4–8. 0	Moderate.
95–100	95–100	10–30	6. 3–20. 0	. 10	5. 6–6. 5	Low.
95–100	90–100	25–35	2. 0–6. 3	. 12	6. 1–7. 3	Low.
55–80	50–70	0–10	>20. 0	. 02	[2] 7. 4–8. 0	Low.
100	95–100	5–10	>20. 0	. 06	5. 6–6. 0	Low.
95–100	90–100	10–25	6. 3–20. 0	. 08	5. 6–6. 0	Low.
100	95–100	60–70	0. 63–2. 0	. 18	6. 6–7. 3	Low.
95–100	95–100	65–80	0. 2–0. 63	. 18	6. 6–7. 3	Moderate.
90–95	85–95	60–80	0. 63–2. 0	. 16	[2] 7. 4–8. 0	Moderate to low.
95–100	85–100	35–50	2. 0–6. 3	. 14	5. 6–7. 3	Low.
85–95	80–95	60–80	0. 2–0. 63	. 16	[2] 7. 4–8. 0	Low to moderate.
100	95–100	5–10	6. 3–1. 0	. 08	5. 1–5. 5	Low.
100	95–100	0–50	>20. 0	. 04	5. 1–6. 0	Low.
100	100	10–25	6. 3–20. 0	. 08	6. 1–6. 5	Low.
100	95–100	5–10	6. 3–20. 0	. 08	6. 6–7. 8	Low.
95–100	95–100	25–45	2. 0–6. 3	. 12	5. 6–6. 0	Low.
95–100	90–100	70–80	0. 63–2. 0	. 18	5. 6–6. 0	Moderate.
95–100	95–100	25–45	2. 0–6. 3	. 12	5. 1–5. 5	Low.
100	95–100	10–25	>20. 0	. 08	5. 6–6. 0	Low.
100	95–100	0–5	>20. 0	. 02	5. 6–6. 0	Low.
100	95–100	5–10	>20. 0	. 08	4. 5–5. 0	Low.
90–100	85–100	0–5	>20. 0	. 04	5. 6–6. 5	Low.
95–100	95–100	15–30	2. 0–6. 3	. 14	6. 6–7. 3	Low.
95–100	90–100	20–35	2. 0–6. 3	. 10	6. 6–7. 3	Low.
100	100	15–20	6. 3–20. 0	. 08	6. 6–7. 3	Low.
95–100	95–100	0–5	>20. 0	. 02	[2] 7. 4–8. 0	Low.
----------------	----------------	----------------	>20. 0	. 50	6. 1–7. 8	Variable.
100	100	80–85	0. 2–0. 63	. 18	5. 6–6. 0	High.
100	100	80–90	<0. 20	. 16	6. 1–7. 3	High.
100	100	75–90	<0. 20	. 16	[2] 7. 4–8. 0	High.
100	100	60–90	0. 63–2. 0	. 18	4. 5–5. 0	Low.
100	100	70–95	0. 2–0. 63	. 16	4. 5–7. 3	Moderate to high.
100	95–100	70–90	0. 2–0. 63	. 16	[2] 7. 4–8. 0	Moderate.

TABLE 4.—*Estimated engineering*

Soil series and map symbols	Depth to seasonal high water table [1]	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	*Inches*			
Lamson: Ld	<1	0–9	Fine sandy loam	SM	A–2 or A–4
		9–62	Layers of silt loam, very fine and loamy very fine sand.	ML–CL, ML and SM	A–2 or A–4
Latty: Le, LhA. Somewhat poor drainage in 40 to 50 percent of LhA.	<1	0–8	Silty clay loam	ML–CL	A–7
		8–39	Clay	CH	A–7
		39–62	Clay	CH	A–7
Latty, sandy subsoil variant: LlA	<1	0–8	Silty clay loam	ML–CL	A–7
		8–38	Clay	CH	A–7
		38–64	Fine sand	SP or SP–SM	A–3
Lenawee: Lm, LnA. Somewhat poor drainage in 30 to 40 percent of LnA.	<1	0–10	Silt loam	ML	A–4
		10–54	Silty clay loam and light silty clay.	CL and MH	A–4 and A–7
		54–62	Stratified very fine sandy loam, silt loam, and silty clay loam.	ML or CL	A–4 or A–7
Londo: LoA, LoB, LpA	1–2	0–11	Loam	ML	A–4
		11–18	Clay loam	CL	A–6
		18–62	Loam	ML–CL	A–4
*Metamora: MeA, MeB, MhA. For Parkhill part of MhA, see Parkhill series.	1–2	0–23	Sandy loam	SM	A–2
		23–62	Clay loam	CL	A–6
Metea: MlB	>3	0–33	Loamy sand and fine sand	SM	A–2
		33–39	Heavy sandy loam	SM	A–4 or A–2
		39–46	Silty clay loam	CL	A–7
		46–64	Clay loam	CL	A–6
*Miami: MmC, MnA, MnB. For Dighton part of MnA and MnB, see Dighton series.	>3	0–9	Loam	ML–CL	A–4
		9–23	Clay loam	CL	A–6
		23–30	Silty clay loam	CL	A–6 or A–7
		30–62	Clay loam	CL	A–6
*Minoa: MoA, MoB, MsA. For Lamson part of MsA, see Lamson series.	1–2	0–19	Fine sandy loam	SM	A–2 or A–4
		19–62	Stratified loamy fine sand, silt loam, and very fine sandy loam.	SM and ML	A–2 and A–4
Minoa, clay substratum: MrA	1–2	0–15	Fine sandy loam	SM	A–2 or A–4
		15–32	Stratified heavy loam, fine sandy loam, and very fine sand.	ML and SM	A–4 and A–2
		32–62	Clay and silt loam	CH and ML	A–7 and A–4
Morley: MtC2, MtD2	>3	0–8	Loam	ML	A–4
		8–20	Clay loam and clay	CL	A–6 or A–7
		20–62	Clay loam	CL	A–6
*Nappanee: NhA. For Hoytville part of NhA, see Hoytville series.	1–2	0–10	Loam	ML–CL	A–4
		10–17	Clay	CH	A–7
		17–62	Clay	CH	A–7
Otisco: OaA	1–2	0–14	Loamy sand	SM	A–2
		14–48	Layers of sand, loamy sand, and sandy loam.	SM and SP–SM	A–2 or A–3
		48–66	Medium, coarse, and very coarse sand.	SP	A–1 or A–3
Palms: Pa	0	0–22	Muck	Pt	----------
		22–62	Silty clay loam	CL or ML–CL	A–7
Parkhill: Pc	<1	0–9	Loam	ML–CL	A–4
		9–28	Clay loam	CL	A–6
		28–46	Silty clay loam	CL	A–6
		46–71	Clay loam and heavy loam	ML–CL	A–6

properties of soils—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
			Inches per hour	*Inches per inch of soil*	*pH value*	
95–100	95–100	20–45	2. 0–6. 3	. 12	6. 6–7. 3	Low.
95–100	95–100	25–70	0. 63–2. 0	. 12	6. 6–7. 8	Low.
100	100	80–95	0. 2–0. 63	. 18	6. 1–6. 5	Moderate.
100	100	75–90	<0. 06	. 14	6. 1–7. 3	High.
100	95–100	75–90	<0. 06	. 14	7. 4–8. 0	High.
100	100	80–95	0. 2–0. 63	. 18	5. 6–6. 0	Moderate.
100	100	75–90	<0. 06	. 14	6. 6–7. 8	High.
100	95–100	0–10	6. 3–20. 0	. 06	[2] 7. 8–8. 0	Low.
100	100	60–90	0. 63–2. 0	. 18	6. 6–7. 3	Low.
100	100	80–95	0. 2–0. 63	. 16	6. 6–7. 8	Moderate.
100	95–100	50–95	0. 2–0. 63	. 16	7. 4–7. 8	Moderate.
100	95–100	60–70	0. 63–2. 0	. 18	6. 6–7. 3	Low.
95–100	95–100	65–80	0. 63–2. 0	. 18	7. 4–7. 8	Moderate.
85–95	85–95	60–70	0. 63–2. 0	. 16	[2] 7. 8–8. 0	Low.
95–100	95–100	15–25	2. 0–6. 3	. 10	5. 1–6. 5	Low.
95–100	90–100	70–85	0. 2–0. 63	. 16	5. 6–7. 8	Moderate.
95–100	95–100	15–30	6. 3–20. 0	. 06	4. 5–6. 0	Low.
95–100	90–100	30–45	2. 0–6. 3	. 12	6. 1–6. 5	Low.
95–100	90–100	70–85	0. 2–0. 63	. 16	6. 1–6. 5	Moderate.
85–95	80–95	60–70	0. 2–0. 63	. 14	[2] 7. 8–8. 0	Moderate.
100	95–100	60–70	0. 63–2. 0	. 16	6. 6–7. 3	Low.
95–100	95–100	65–80	0. 63–2. 0	. 18	5. 6–6. 5	Moderate.
95–100	95–100	70–85	0. 2–0. 63	. 16	7. 4–7. 8	Moderate.
90–95	85–95	60–75	0. 2–0. 63	. 14	[2] 7. 8–8. 0	Moderate to low.
95–100	95–100	20–45	2. 0–6. 3	. 12	6. 6–7. 3	Low.
100	95–100	25–70	0. 63–2. 0	. 14	6. 6–7. 3	Low.
95–100	95–100	20–45	2. 0–6. 3	. 12	6. 1–7. 3	Low.
100	95–100	30–70	0. 63–2. 0	. 14	6. 6–7. 8	Low.
100	95–100	70–95	<0. 06	. 16	[2] 7. 8–8. 0	High.
95–100	95–100	55–65	0. 63–2. 0	. 18	6. 1–7. 3	Low.
95–100	95–100	70–85	0. 06–0. 20	. 16	6. 1–7. 3	Moderate to high.
90–95	85–95	70–80	0. 2–0. 63	. 16	[2] 7. 4–8. 0	Moderate.
100	100	60–75	0. 63–2. 0	. 14	6. 1–6. 5	Low.
100	95–100	80–90	<0. 2	. 14	6. 0–7. 3	High.
100	95–100	75–95	<0. 2	. 14	[2] 7. 4–8. 0	High.
100	95–100	15–30	6. 3–20. 0	. 10	5. 6–6. 5	Low.
100	95–100	5–25	6. 3–20. 0	. 10	6. 6–7. 8	Low.
95–100	95–100	0–5	>20. 0	. 14	[2] 7. 4–8. 0	Low.
----------	----------	----------	>20. 0	. 50	6. 6–7. 8	Variable.
95–100	90–100	60–90	0. 2–0. 63	. 14	[2] 7. 4–8. 0	Moderate.
100	100	60–70	0. 63–2. 0	. 20	7. 4–7. 8	Low.
100	95–100	65–80	0. 63–2. 0	. 18	6. 6–7. 3	Low to moderate.
100	95–100	70–90	0. 2–0. 63	. 16	7. 4–7. 8	Moderate.
95–100	95–100	60–80	0. 63–2. 0	. 16	[2] 7. 8–8. 0	Low to moderate.

TABLE 4.—*Estimated engineering*

Soil series and map symbols	Depth to seasonal high water table [1]	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Feet	*Inches*			
Paulding: Pd	<1	0–10	Clay	CH	A-7
		10–39	Clay	CH	A-7
		39–60	Clay	CH	A-7
*Pert: PeB, PlB. For Sims part of PlB, see Sims series.	1–2	0–7	Loam	ML	A-4
		7–17	Clay	CL	A-7
		17–62	Silty clay loam	CL	A-6
Pinconning: Pn	<1	0–27	Mucky fine sand	SM	A-2
		27–62	Clay	CH	A-7
Rousseau: RuB, RuC	>4	0–44	Fine sand	SP–SM	A-3
		44–64	Stratified fine sand and sand	SP–SM and SP	A-2 and A-3
Sanilac: SaA	1–2	0–12	Very fine sandy loam	ML	A-4
		12–64	Stratified loamy very fine sand, silt loam, and very fine sandy loam.	ML and SM	A-4
Sims: Sm	<1	0–9	Loam	ML–CL	A-4
		9–30	Silty clay loam and light clay	CL	A-7
		30–62	Silty clay loam	CL	A-6
Spinks: SpA, SpB	>4	0–20	Loamy sand	SM	A-2
		20–66	Layers of sand and loamy sand	SM and SP–SM	A-2 and A-3
		66–75	Stratified sand and gravel	SP or SP–SM	A-1
Spinks, loamy substratum: SsB	>3	0–10	Loamy sand	SM	A-2
		10–51	Layers of sand and loamy sand	SM and SP–SM	A-2 and A-3
		51–58	Very fine sandy loam	ML	A-4
		58–64	Silty clay loam	CL or ML–CL	A-7
Thomas: Th. Calcareous, clayey soils in 40 to 50 percent of this mapping unit.	<1	0–9	Mucky silt loam	CL	A-4
		9–31	Silty clay loam	CL	A-7
		31–62	Stratified silt loam, clay loam, silty clay loam, and silty clay.	ML, CL and CH	A-4, A-6, and A-7
Tobico. Mapped only with Wainola soils.	<1	0–7	Mucky fine sand	SM	A-2
		7–60	Sand and fine sand	SP or SP–SM	A-3
Toledo: To	<1	0–9	Silty clay loam	CL	A-7
		9–41	Clay and silty clay	CH	A-7
		41–64	Clay loam, fine sandy loam, and silty clay.	CL, SM, and CH	A-4, A-6 and A-7
*Wainola: WaA, WdA, WnA. For Deford part of WdA, see Deford series; for Tobico part of WnA, see Tobico series.	1–2	0–9	Fine sand	SM	A-2
		9–62	Fine sand	SP–SM and SM	A-3 and A-2
*Wasepi: WoA	1–2	0–9	Sandy loam	SM	A-2
		9–18	Sandy loam	SM or SC	A-2 or A-6
		18–29	Loamy sand	SM	A-2
		29–62	Gravelly sand and sand	SP and SP–SM	A-1
WpB. For Boyer part see Boyer series.	1–3	0–34	Loamy sand and sandy loam	SM	A-2
		34–47	Stratified sand and gravel	SP or SP–SM	A-1
		47–62	Loam or silty clay loam	ML or CL	A-4 or A-6
Wasepi, clay subsoil variant: WsA	1–2	0–22	Sandy loam	SM	A-2
		22–38	Gravelly sand and gravelly loamy sand.	SM and SP–SM	A-2 and A-3
		38–62	Clay	CH	A-7

[1] Assuming no artificial drainage.
[2] Calcareous.

properties of soils—Continued

Percentage passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Shrink-swell potential
			Inches per hour	*Inches per inch of soil*	*pH value*	
100	100	80–90	0. 06–0. 2	. 18	6. 8–7. 3	High.
100	95–100	90–100	<0. 06	. 14	6. 6–7. 8	High.
100	95–100	90–95	<0. 06	. 12	[2] 7. 8–8. 0	High.
95–100	95–100	55–70	0. 63–2. 0	. 18	6. 8–7. 3	Low.
95–100	95–100	70–85	0. 06–0. 2	. 14	6. 6–7. 3	High.
90–95	85–95	70–80	0. 2–0. 63	. 16	[2] 7. 4–8. 0	Moderate.
100	100	10–25	6. 3–20. 0	. 08	6. 6–7. 8	Low.
100	95–100	75–95	<0. 06	. 14	[2] 7. 8–8. 0	High.
100	95–100	5–10	6. 3–20. 0	. 08	5. 1–6. 0	Low.
100	95–100	5–10	6. 3–20. 0	. 04	5. 6–6. 0	Low.
100	100	55–65	2. 0–6. 3	. 16	7. 4–7. 8	Low.
100	100	40–80	0. 63–2. 0	. 12	[2] 7. 8–8. 0	Low.
100	100	60–70	0. 63–2. 0	. 18	6. 1–6. 4	Low.
100	95–100	75–90	0. 06–0. 2	. 18	6. 6–7. 8	Moderate to high.
100	95–100	70–90	0. 2–0. 63	. 16	[2] 7. 8–8. 0	Moderate.
100	100	10–20	6. 3–20. 0	. 08	5. 1–6. 0	Low.
100	95–100	5–25	6. 3–20. 0	. 08	5. 6–6. 0	Low.
55–80	50–70	0–10	>20. 0	. 04	[2] 7. 4–8. 0	Low.
100	100	10–20	6. 3–20. 0	. 08	5. 6–6. 0	Low.
100	95–100	5–25	6. 3–20. 0	. 08	5. 6–7. 3	Low.
100	95–100	55–65	2. 0–6. 3	. 14	[2] 7. 4–8. 0	Low.
90–100	85–95	60–90	0. 2–0. 63	. 16	[2] 7. 4–8. 0	Moderate to high.
100	100	70–90	0. 63–2. 0	. 18	6. 1–6. 5	Low.
100	95–100	85–90	0. 2–0. 63	. 16	[2] 7. 4–7. 8	Moderate.
100	95–100	70–95	0. 2–0. 63	. 16	[2] 7. 4–8. 0	Moderate to high.
100	100	10–20	6. 3–20. 0	. 10	7. 4–7. 8	Low.
100	95–100	0–10	6. 3–20. 0	. 04	[2] 7. 4–8. 0	Low.
100	100	80–95	0. 2–0. 63	. 18	6. 6–7. 3	Moderate.
100	100	75–95	0. 06–0. 2	. 16	6. 6–7. 8	High.
100	95–100	40–95	0. 2–0. 63	. 18	[2] 7. 8–8. 0	Moderate to high.
100	100	10–25	6. 3–20. 0	. 10	5. 6–6. 0	Low.
100	95–100	5–25	6. 3–20. 0	. 08	5. 6–6. 5	Low.
95–100	90–95	15–30	2. 0–6. 3	. 14	5. 1–5. 5	Low.
95–100	90–95	30–40	2. 0–6. 3	. 10	5. 1–5. 5	Low.
95–100	85–95	15–25	6. 3–20. 0	. 04	5. 6–6. 0	Low.
65–80	60–75	0–10	>20. 0	. 02	6. 1–6. 5	Low.
90–95	85–95	15–35	2. 0–6. 3	. 12	5. 6–7. 3	Low.
75–90	65–80	0–10	>20. 0	. 02	[2] 7. 4–7. 8	Low.
95–100	85–95	70–90	0. 2–0. 63	. 16	[2] 7. 8–8. 0	Low to moderate.
90–100	80–95	25–35	2. 0–6. 3	. 14	5. 6–7. 8	Low.
70–85	70–80	5–20	>20. 0	. 05	[2] 7. 8–8. 0	Low.
100	100	75–95	<0. 06	. 16	[2] 7. 8–8. 0	High.

TABLE 5.—*Engineering*

[Alluvial land (Au), Borrow pits (Bp), Lake beaches (La), Made land (Md), and Rough broken land (Ro) are not listed in this table. They is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for

Soil series and map symbols	Suitability as source of—			
	Topsoil [1]	Sand	Gravel	Road fill
*Allendale: AeA, AhB, AlA, AtA. For Hoytville part of AhB, see Hoytville series; for Latty part of AlA, see Latty series; for Lenawee and Toledo parts of AtA, see Lenawee and Toledo series.	Poor: 7 inches thick; sandy; low content of organic matter; droughty.	Fair: 18 to 40 inches of sandy material; some fines; seasonal high water table hinders excavation.	Not suitable	Fair to a depth of 18 to 40 inches: low shrink-swell potential; good workability. Poor below 18 to 40 inches: high shrink-swell potential; difficult to work and compact.
Avoca: AvA	Poor: 10 inches thick; low content of organic matter; droughty.	Fair: 18 to 40 inches of sandy material; seasonal high water table hinders excavation.	Not suitable	Fair to a depth of 18 to 40 inches: low shrink-swell potential; good workability. Poor at a depth below 18 to 40 inches: low to moderate shrink-swell potential; fair workability.
Bach: Bc	Good: 8 inches thick; loamy; high content of organic matter; erodible.	Not suitable	Not suitable	Poor: unstable when wet; wetness hinders excavation.
Blount: BlA, BlB	Fair: 9 inches thick; loamy; moderate content of organic matter; crusts slightly when dry.	Not suitable	Not suitable	Poor to fair: moderate to high shrink-swell potential; difficult to work and compact.
Boyer: BrB	Poor: 10 inches thick; sandy; low content of organic matter; droughty.	Good: sandy material that has some fines and gravel.	Fair in substratum; more than 50 percent sand.	Good: low shrink-swell potential; sandy and gravelly material that has some fines.
*Chelsea: CcB. For Croswell part see Croswell series.	Poor: 8 inches thick; sandy; low content of organic matter; droughty.	Good: sandy material that has few thin layers of fines.	Not suitable	Fair: low shrink-swell potential; good if soil binder is added.
*Conover: CvA, CvB, CwA. For Parkhill part of CwA, see Parkhill series.	Good: 10 inches thick; loamy; moderate content of organic matter.	Not suitable	Not suitable	Fair: low to moderate shrink-swell potential; good workability and stability.
Corunna: Cx	Good: 10 inches thick; loamy; high content of organic matter.	Not suitable	Not suitable	Fair: low to moderate shrink-swell potential; good workability and stability; wetness hinders excavation.
*Croswell: CyB. For Lamson part see Lamson series.	Poor: 7 inches thick; sandy; low content of organic matter; droughty.	Good: sandy material to a depth of 60 inches or more.	Not suitable	Fair: low shrink-swell potential; good if soil binder is added.

interpretations for specified uses

are so variable that onsite investigation is needed. An asterisk in the first column indicates that at least one mapping unit in this series this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil features affecting suitability for—			Corrosivity to—		Limitations for septic tank disposal fields
Highway location	Foundations for low buildings	Winter grading	Uncoated steel	Concrete	
Seasonal high water table; clayey material at a depth of 18 to 40 inches; unstable and plastic when wet; subject to frost heave.	Seasonal high water table; high shrink-swell potential; high compressibility; poor shear strength.	Seasonal high water table; high moisture content often hinders operations; poor stability upon thawing.	High	Low	Severe: seasonal high water table; very slow permeability; clayey material within 18 to 40 inches of surface; onsite investigation needed.
Seasonal high water table; loamy material at a depth of 18 to 40 inches; subject to frost heave.	Seasonal high water table; low to moderate shrink-swell potential; medium compressibility; fair shear strength.	Seasonal high water table; high moisture content often hinders operations; poor stability upon thawing.	High	Low	Severe: seasonal high water table; moderately slow permeability at a depth of 18 to 40 inches; onsite investigation needed.
Seasonal high water table; wetness hinders construction; soil loses stability and flows when wet; subject to frost heave.	Seasonal high water table; low to moderate shrink-swell potential; slight to medium compressibility; fair to good shear strength; subject to liquefaction and piping.	Seasonal high water table; poor stability upon thawing.	High	Low	Severe: seasonal high water table; unstable soil may plug tile and filter beds; filter fields saturated during wet periods.
Seasonal high water table: subject to frost heave.	Seasonal high water table; moderate shrink-swell potential; medium compressibility; fair shear strength.	Seasonal high water table; moisture content often too high for compaction; poor stability upon thawing.	High	Low	Severe: seasonal high water table; slow permeability; onsite investigation needed.
Features favorable	Low shrink-swell potential; slight compressibility; good shear strength.	Normally low to medium moisture content; fair stability upon thawing.	Low	Low	Slight.
Loose sand hinders construction.	Low shrink-swell potential; slight compressibility; good shear strength.	Sandy; normally low moisture content; good stability upon thawing.	Low	Low	Slight.
Seasonal high water table; subject to frost heave.	Seasonal high water table; low to moderate shrink-swell potential; medium compressibility; fair shear strength.	Seasonal high water table; moisture content often too high for good compaction; poor stability upon thawing.	High	Low	Severe: seasonal high water table; moderately slow permeability; onsite investigation needed.
Seasonal high water table; wetness hinders construction; substratum subject to frost heave.	Seasonal high water table; low to moderate shrink-swell potential; medium compressibility; fair shear strength.	Seasonal high water table; wetness hinders operations.	High	Low	Severe: seasonal high water table; filter fields saturated during wet periods.
Loose sand hinders construction.	Low shrink-swell potential; slight compressibility; good shear strength.	Sandy; normally low moisture content; good stability upon thawing.	Low	Low	Slight to moderate: water table within a depth of 3 feet of surface during wet periods; possible pollution of shallow water supplies by effluent; onsite investigation needed.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—			
	Topsoil [1]	Sand	Gravel	Road fill
Deford: De	Poor: 9 inches thick; sandy; high content of organic matter; erodible.	Fair: fine sandy material; wetness hinders excavation in many areas.	Not suitable	Fair: low shrink-swell potential; unstable when wet; erodible; wetness hinders excavation.
Dighton Mapped only in complexes with Miami soils.	Fair: 8 inches thick; loamy; low content of organic matter.	Fair: sandy material below a depth of 20 to 40 inches; variable content of fines.	Not suitable	Fair to a depth of 20 to 40 inches: moderate shrink-swell potential; good workability and stability. Fair below a depth of 20 to 40 inches: low shrink-swell potential; good if soil binder is added.
Eastport: EaB, EaC	Poor: 7 inches thick; sandy; low content of organic matter; droughty.	Good: sandy material to a depth of 60 inches or more.	Poor: thin gravelly layers in some areas.	Fair: low shrink-swell potential; good if soil binder is added.
Gilford: Gd	Good: 10 inches thick; loamy; high content of organic matter.	Good: sandy substratum; wetness hinders excavation in many areas.	Fair to poor: gravelly layers in some areas; wetness hinders excavation.	Good: low shrink-swell potential; wetness hinders excavation.
Houghton: Ha	Poor: organic material; oxidizes readily; erodible. Fair to good if mixed with mineral material.	Not suitable	Not suitable	Not suitable: highly unstable organic material.
Hoytville Mapped only in complexes with Allendale and Nappanee soils.	Poor: 9 inches thick; loamy; high content of organic matter; crusts when dry; poor workability.	Not suitable	Not suitable	Poor: high shrink-swell potential; difficult to work and compact; wetness hinders excavation.
Jeddo: Ja	Good: 8 inches thick; loamy; high content of organic matter; erodible.	Not suitable	Not suitable	Poor: moderate to high shrink-swell potential; difficult to work and compact; wetness hinders excavation.
Lamson: Ld	Good: 9 inches thick; loamy; high content of organic matter; erodible.	Not suitable	Not suitable	Fair: low shrink-swell potential; unstable when wet; erodible; wetness hinders excavation.

interpretations for specified uses—Continued

Soil features affecting suitability for—			Corrosivity to—		Limitations for septic tank disposal fields
Highway location	Foundations for low buildings	Winter grading	Uncoated steel	Concrete	
Seasonal high water table; wetness hinders construction; loses stability and flows when wet.	Seasonal high water table; low shrink-swell potential; slight compressibility; good shear strength; subject to liquefaction and piping.	Seasonal high water table; fair stability upon thawing; wetness hinders operations.	High	Low	Severe: seasonal high water table; filter fields saturated during wet periods.
Features favorable	Low shrink-swell potential; slight compressibility; good shear strength.	Moisture content usually too high for good compaction; poor stability upon thawing.	Low to moderate.	Low	Moderate: very rapid drainage at a depth of about 20 to 40 inches; onsite investigation needed.
Loose sand hinders construction; cuts and fills needed in many places.	Low shrink-swell potential; slight compressibility; good shear strength.	Sandy; normally low moisture content; good stability upon thawing.	Low	Low	Moderate: possible pollution of shallow water supplies by effluent; slopes of more than 10 percent hinder installation and operation of filter fields.
Seasonal high water table; wetness hinders construction.	Seasonal high water table; low shrink-swell potential; slight compressibility; good shear strength.	Seasonal high water table; wetness often hinders operations.	High	Low	Severe: seasonal high water table; filter fields saturated during wet periods.
Seasonal high water table; wetness hinders construction; organic material is very unstable.	Seasonal high water table; high compressibility; very unstable.	Seasonal high water table; unstable organic material.	High	Moderate	Severe: seasonal high water table; unstable organic material; filter fields saturated during wet periods.
Seasonal high water table; wetness hinders construction; unstable and plastic when wet; subject to frost heave.	Seasonal high water table; high shrink-swell potential; high compressibility; poor shear strength.	Seasonal high water table; clayey; poor stability upon thawing.	High	Low	Severe: seasonal high water table; slowly permeable; expansive, clayey material; filter fields saturated during wet periods.
Seasonal high water table; wetness hinders construction; unstable; subject to frost heave when wet.	Seasonal high water moderate shrink-swell potential; medium compressibility; fair shear strength.	Seasonal high water table; poor stability upon thawing.	High	Low	Severe: seasonal high water table; moderately slow permeability; filter fields saturated during wet periods.
Seasonal high water table; wetness hinders construction; some areas subject to flooding; substratum loses stability and flows when wet; subject to frost heave.	Seasonal high water table; subject to flooding in some areas; low shrink-swell potential; slight to medium compressibility; fair shear strength; subject to liquefaction and piping.	Seasonal high water table; poor stability upon thawing; wetness hinders operations.	High	Low	Severe: seasonal high water table; some areas subject to stream overflow; unstable soil material may plug tile and filter beds; filter fields saturated during wet periods.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—			
	Topsoil [1]	Sand	Gravel	Road fill
Latty: Le, LhA	Poor: 8 inches thick; loamy; high content of organic matter; crusts when dry; poor workability.	Not suitable	Not suitable	Poor: high shrink-swell potential; difficult to work and compact; wetness hinders excavation.
Latty, sandy subsoil variant: LlA	Poor: 8 inches thick; loamy; moderate content of organic matter; crusts when dry.	Fair: sandy substratum at a depth of 20 to 40 inches; wetness hinders excavation.	Not suitable	Poor in upper 20 to 40 inches: high shrink-swell potential; difficult to work and compact. Fair below 20 to 40 inches: low shrink-swell potential; wetness hinders excavation.
Lenawee: Lm, LnA	Fair: 10 inches thick; loamy; high content of organic matter; erodible.	Not suitable	Not suitable	Poor: moderate shrink-swell potential; unstable when wet; difficult to work and compact; wetness hinders excavation.
Londo: LoA, LoB, LpA	Good: 8 inches thick; loamy; moderate content of organic matter. Loamy sand to a depth of 10 to 17 inches in 40 to 70 percent of LpA.	Not suitable	Not suitable	Fair: moderate shrink-swell potential; fair workability and stability.
*Metamora: MeA, MeB, MhA. For Parkhill part of MhA see Parkhill series.	Fair: 10 inches thick; loamy; moderate content of organic matter.	Not suitable	Not suitable	Good to a depth of 18 to 40 inches: low shrink-swell potential; good workability and stability. Fair below 18 to 40 inches: moderate shrink-swell potential; fair workability.
Metea: MlB	Poor: 5 inches thick; sandy; low content of organic matter; droughty.	Fair: 18 to 40 inches of sandy material.	Not suitable	Fair to a depth of 18 to 40 inches: low shrink-swell potential; good if soil binder is added. Fair below 18 to 40 inches: moderate shrink-swell potential; fair workability.
*Miami: MmC, MnA, MnB. For Dighton part of MnA, and MnB see Dighton series.	Fair: 9 inches thick; loamy, moderate content of organic matter.	Not suitable	Not suitable	Fair: low to moderate shrink-swell potential; fair workability and stability.

interpretations for specified uses—Continued

Soil features affecting suitability for—			Corrosivity to—		Limitations for septic tank disposal fields
Highway location	Foundations for low buildings	Winter grading	Uncoated steel	Concrete	
Seasonal high water table; wetness hinders construction; unstable and plastic when wet; subject to frost heave.	Seasonal high water table; high shrink-swell potential; high compressibility; poor shear strength.	Seasonal high water table; clayey; poor stability upon thawing.	High	Low	Severe: seasonal high water table; very slow permeability; expansive, clayey material; filter fields saturated during wet periods.
Seasonal high water table; wetness hinders construction; unstable and plastic when wet; subject to frost heave to a depth of 20 to 40 inches.	Seasonal high water table; low shrink-swell potential; slight compressibility; fair to good shear strength; subject to liquefaction and piping.	Seasonal high water table; clayey; poor stability upon thawing.	High	Low	Severe: seasonal high water table; very slow permeability; expansive, clayey material; filter fields saturated during wet periods.
Seasonal high water table; wetness hinders construction; unstable when wet; subject to frost heave.	Seasonal high water table; moderate shrink-swell potential; medium compressibility; poor to fair shear strength; subject to liquefaction and piping.	Seasonal high water table; poor stability upon thawing.	High	Low	Severe: seasonal high water table; moderately slow permeability; filter fields saturated during wet periods.
Seasonal high water table; subject to frost heave.	Seasonal high water table; low shrink-swell potential; medium compressibility; fair shear strength.	Seasonal high water table; moisture content often too high for good compaction; poor stability upon thawing.	High	Low	Severe: seasonal high water table; moderate permeability; onsite investigation needed.
Seasonal high water table.	Seasonal high water table; moderate shrink-swell potential; medium compressibility; fine shear strength.	Seasonal high water table; moisture content often too high for good compaction; poor stability upon thawing.	High	Low	Severe: seasonal high water table; variable permeability; onsite investigation needed.
Loose sand to a depth of 18 to 40 inches hinders construction.	Moderate shrink-swell potential; medium compressibility; fine shear strength.	Moisture content often too high for good compaction; poor stability upon thawing.	Moderate	Low	Moderate: moderately slow permeability at a depth of 18 to 40 inches; onsite investigation needed.
Cuts and fills needed in many places.	Low to moderate shrink-swell potential; medium compressibility; fair shear strength.	Moisture content often too high for good compaction; poor stability upon thawing.	Moderate	Low	Moderate: moderately slow permeability; slopes of more than 10 percent hinder installation and operation of filter fields; onsite investigation needed.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—			
	Topsoil [1]	Sand	Gravel	Road fill
*Minoa: MoA, MoB, MsA. For Lamson part of MsA, see Lamson series.	Good: 9 inches thick; loamy; moderate content of organic matter; erodible.	Not suitable	Not suitable	Fair: low shrink-swell potential; fair workability; unstable when wet; erodible.
Minoa, clay substratum: MrA	Good: 9 inches thick; loamy; moderate content of organic matter; erodible.	Not suitable	Not suitable	Fair in uppermost 30 to 50 inches: low shrink-swell potential; fair workability; unstable when wet; erodible. Poor below 30 to 50 inches: high shrink-swell potential; difficult to work and compact.
Morley: MtC2, MtD2	Fair: 6 to 8 inches thick; loamy; low content of organic matter; crusts slightly when dry.	Not suitable	Not suitable	Poor to fair: moderate to high shrink-swell potential; difficult to work and compact.
*Nappanee: NhA. For Hoytville part, see Hoytville series.	Fair: 10 inches thick; loamy; moderate content of organic matter; crusts slightly when dry.	Not suitable	Not suitable	Poor: high shrink-swell potential; difficult to work and compact.
Otisco: OaA	Poor: 8 inches thick; sandy; low content of organic matter; droughty.	Good: sandy material to a depth of 60 inches or more; seasonal high water table hinders excavation.	Not suitable	Fair: low shrink-swell potential; good if soil binder is added.
Palms: Pa	Poor: organic material; oxidizes readily; erodible; fair to good if mixed with mineral material.	Not suitable	Not suitable	Not suitable in uppermost 16 to 50 inches: highly unstable organic material. Poor below 16 to 50 inches: moderate shrink-swell potential; difficult to work and compact; wetness hinders excavation.
Parkhill: Pc	Good: 9 inches thick; loamy; high content of organic matter.	Not suitable	Not suitable	Fair: low to moderate shrink-swell potential; fair workability and stability; wetness hinders excavation.

interpretations for specified uses—Continued

Soil features affecting suitability for—			Corrosivity to—		Limitations for septic tank disposal fields
Highway location	Foundations for low buildings	Winter grading	Uncoated steel	Concrete	
Seasonal high water table; subject to flooding in some areas; loses stability and flows when wet; subject to frost heave.	Seasonal high water table; low shrink-swell potential; slight to medium compressibility; poor to fair shear strength; subject to liquefaction and piping.	Seasonal high water table; moisture content often too high for good compaction; poor stability upon thawing.	Moderate	Low	Severe: seasonal high water table; some areas subject to stream overflow; unstable soil material may plug tile and filter beds; onsite investigation needed.
Seasonal high water table; material above a depth of 30 to 50 inches loses stability and flows when wet; subject to frost heave.	Seasonal high water table; high shrink-swell potential; medium to high compressibility; poor shear strength; subject to liquefaction and piping.	Seasonal high water table; moisture content often too high for good compaction; poor stability upon thawing.	Moderate in sands; high in clayey material.	Low	Severe: seasonal high water table; clayey lower part has very slow permeability; unstable soil material may plug tile and filter beds; onsite investigation needed.
Subject to frost heave; cuts and fills needed in many places; erodible when exposed on embankments.	Moderate shrink-swell potential; medium compressibility; fair shear strength.	Moisture content often too high for good compaction; poor stability upon thawing.	Moderate	Low	Severe: slowly permeable; slopes of more than 10 percent hinder installation and operation of filter fields; onsite investigation needed.
Seasonal high water table; unstable and plastic when wet; subject to frost heave.	Seasonal high water table; high shrink-swell potential; high compressibility; poor shear strength.	Seasonal high water table; high moisture content often hinders operations; clayey; poor stability upon thawing.	High	Low	Severe: seasonal high water table; slow permeability; expansive, clayey material; onsite investigation needed.
Seasonal high water table; loose sand hinders construction.	Seasonal high water table; low shrink-swell potential; slight compressibility; good shear strength.	Seasonal high water table; wetness often hinders operations.	Low	Low	Severe: seasonal high water table; rapid percolation of effluent may pollute water supplies; onsite investigation needed.
Seasonal high water table; wetness hinders construction; 16 to 50 inches of organic material; very unstable; substratum subject to frost heave.	Seasonal high water table; moderate shrink-swell potential; medium compressibility; fair shear strength.	Seasonal high water table; unstable organic material.	High	Low	Severe: seasonal high water table; unstable organic material; filter fields saturated during wet periods.
Seasonal high water table; wetness hinders construction; subject to frost heave.	Seasonal high water table; low to moderate shrink-swell potential; medium compressibility; fair shear strength.	Seasonal high water table; poor stability upon thawing.	High	Low	Severe: seasonal high water table; moderately slow permeability; filter fields saturated during wet periods.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—			
	Topsoil [1]	Sand	Gravel	Road fill
Paulding: Pd	Poor: 10 inches thick; clayey; high content of organic matter; crusts hard when dry; very poor workability.	Not suitable	Not suitable	Poor: high shrink-swell potential; very difficult to work and compact; wetness hinders excavation.
*Pert: PeB, PlB. For Sims part of PlB, see Sims series.	Fair: 7 inches thick; loamy; moderate content of organic matter; crusts slightly when dry.	Not suitable	Not suitable	Fair: moderate to high shrink-swell potential; difficult to work and compact.
Pinconning: Pn	Poor: 8 inches thick; sandy; high content of organic matter, erodible.	Fair: 18 to 40 inches of fine sandy material; wetness hinders excavation in many areas.	Not suitable	Fair in uppermost 18 to 40 inches: low shrink-swell potential; good workability; unstable when wet; erodible. Poor below 18 to 40 inches: high shrink-swell potential; difficult to work and compact; wetness hinders excavation.
Rousseau: RuB, RuC	Poor: 5 inches thick; sandy; low content of organic matter; droughty.	Good: sandy material to a depth of 60 inches or more.	Not suitable	Fair: low shrink-swell potential; good if soil binder is added.
Sanilac: SaA	Good: 12 inches thick; loamy; moderate content of organic matter.	Not suitable	Not suitable	Poor: low shrink-swell potential; unstable when wet; erodible.
Sims: Sm	Good: 9 inches thick; loamy; high content of organic matter.	Not suitable	Not suitable	Poor to fair: moderate to high shrink-swell potential; difficult to work and compact; wetness hinders excavation.
Spinks: SpA, SpB	Poor: 9 inches thick; sandy; low content of organic matter; droughty.	Good: sandy material that has thin layers of fines.	Fair in substratum: more than 50 percent sand.	Generally fair: low shrink-swell potential; good if soil binder is added.
Spinks, loamy substratum: SsB	Poor: 10 inches thick; sandy; low content of organic matter; droughty.	Fair: 42 to 66 inches of sandy material that has few thin layers of fines.	Not suitable	Fair in uppermost 42 to 66 inches: low shrink-swell potential, good if soil binder is added. Poor to fair below 42 to 66 inches: moderate to high shrink-swell potential; difficult to work and compact.

interpretations for specified uses—Continued

Soil features affecting suitability for—			Corrosivity to—		Limitations for septic tank disposal fields
Highway location	Foundations for low buildings	Winter grading	Uncoated steel	Concrete	
Seasonal high water table; wetness hinders construction; unstable and plastic when wet; subject to frost heave.	Seasonal high water table; high shrink-swell potential; high compressibility; poor shear strength.	Seasonal high water table; clayey; poor stability upon thawing.	High	Low	Severe: seasonal high water table; very slow permeability; expansive clay; filter fields saturated during wet periods.
Seasonal high water table; subject to frost heave.	Seasonal high water table; moderate shrink-swell potential; medium compressibility; fair shear strength.	Seasonal high water table; moisture content often too high for good compaction; poor stability upon thawing.	High	Low	Severe: seasonal high water table; slow permeability; onsite investigation needed.
Seasonal high water table; wetness hinders construction; sandy material above a depth of 18 to 40 inches loses stability and flows when wet; clayey material below 18 to 40 inches is unstable and plastic when wet, subject to frost heave.	Seasonal high water table; high shrink-swell potential; high compressibility; poor shear strength.	Seasonal high water table; fair stability upon thawing; wetness hinders operations.	High	Low	Severe: seasonal high water table; very slowly permeable clay at a depth of 18 to 40 inches; filter fields saturated during wet periods.
Loose sands hinder construction; cuts and fills needed in many places.	Low shrink-swell potential; slight compressibility; good shear strength.	Sandy; normally low moisture content; good stability upon thawing.	Low	Low	Moderate: possible pollution of shallow water supplies by effluent; slopes of more then 10 percent hinder installation and operation of filter fields.
Seasonal high water table; substratum loses stability and flows when wet; subject to frost heave.	Seasonal high water table; low shrink-swell potential, slight to medium compressibility; poor to fair shear strength; subject to liquefaction and piping.	Seasonal high water table; moisture content often too high for good compaction; poor stability upon thawing.	Moderate	Low	Severe: seasonal high water table; unstable soil material may plug tile and filter fields.
Seasonal high water table; wetness hinders construction; subject to frost heave.	Seasonal high water table; moderate shrink-swell potential; medium compressibility; fair shear strength.	Seasonal high water table; poor stability upon thawing.	High	Low	Severe: seasonal high water table; slow permeability; filter fields saturated during wet periods.
Loose sands hinder construction.	Low shrink-swell potential; slight compressibility; good shear strength.	Sandy; normally low moisture content; good stability upon thawing.	Low	Low	Slight.
Loose sands hinder construction; substratum unstable when wet and subject to frost heave.	Moderate to high shrink-swell potential; medium compressibility; fair shear strength.	Sandy; normally low moisture content; good stability upon thawing.	Low	Low	Slight.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—			
	Topsoil [1]	Sand	Gravel	Road fill
Thomas: Th	Good: 9 inches thick; high content of organic matter; erodible; loamy in many places, but calcareous, clayey material in 40 to 50 percent of acreage.	Not suitable	Not suitable	Poor to fair: moderate to high shrink-swell potential; difficult to work and compact; wetness hinders excavation.
Tobico Mapped only in a complex with Wainola soils.	Poor: 7 inches thick; sandy; high content of organic matter; erodible.	Good: wetness hinders excavation in many areas.	Not suitable	Fair: low shrink-swell potential; unstable when wet; erodible; wetness hinders excavation.
Toledo: To	Poor: 9 inches thick; loamy; high content or organic matter; crusts when dry; poor workability.	Not suitable	Not suitable	Poor: moderate to high shrink-swell potential; difficult to work and compact; substratum unstable when wet; wetness hinders excavation.
*Wainola: WaA, WdA, WnA For Tobico part of WnA, see Tobico series.	Poor: 9 inches thick; sandy; low content of organic matter.	Fair: fine sandy material; seasonal high water table hinders excavation.	Not suitable	Fair: low shrink-swell potential; unstable when wet; erodible.
Wasepi: WoA	Fair: 9 inches thick; loamy; moderate organic-matter content.	Good: sandy material that has some fines and gravel; seasonal high water table hinders excavation.	Fair in substratum: more than 50 percent sand; seasonal high water table hinders excavation.	Good: low shrink-swell potential; sandy and gravelly material that has some fines.
*Wasepi-Boyer complex, loamy substratum: WpB. For Boyer part, see Boyer series.	Fair for loamy part: 9 inches thick; moderate organic-matter content. Poor for sandy part: 10 inches thick; low content of organic matter.	Fair: 42 to 66 inches of sandy material that has some fines and gravel; seasonal high water table hinders excavation in some areas.	Fair: 42 to 66 inches of material that is more than 50 percent sand; seasonal high water table hinders excavation in some areas.	Good in uppermost 42 to 66 inches: low shrink-swell potential; sandy and gravelly material that has some fines. Fair below 42 to 66 inches: low to moderate shrink-swell potential; fair workability.
Wasepi, clay subsoil variant: WsA	Fair: 8 inches thick; loamy; moderate content of organic matter.	Fair: 18 to 40 inches of sandy material that has some fines; seasonal high water table hinders excavation.	Fair to poor: 18 to 40 inches of sandy material that has a variable content of gravel; seasonal high water table hinders excavation.	Good in uppermost 18 to 40 inches: low shrink-swell potential; sandy and gravelly material that has some fines. Poor below 18 to 40 inches: high shrink-swell potential; difficult to work and compact.

[1] Thickness given is that of the surface layer in a typical profile. Unless otherwise stated, only the surface layer of a mineral soil is considered suitable as a source of topsoil.

interpretations for specified uses—Continued

Soil features affecting suitability for—			Corrosivity to—		Limitations for septic tank disposal fields
Highway location	Foundations for low buildings	Winter grading	Uncoated steel	Concrete	
Seasonal high water table; wetness hinders construction; unstable; subject to frost heave.	Seasonal high water table; moderate to high shrink-swell potential; medium to high compressibility; poor shear strength; subject to liquefaction and piping.	Seasonal high water table; poor stability upon thawing.	High	Low	Severe: seasonal high water table; moderately slow permeability; filter fields saturated during wet periods.
Seasonal high water table; wetness hinders construction loses stability and flows when wet.	Seasonal high water table; low shrink-swell potential; slight compressibility; fair to good shear strength.	Seasonal high water table; wetness hinders operations.	High	Low	Severe: seasonal high water table; filter fields saturated during wet periods.
Seasonal high water table; wetness hinders construction; unstable and plastic when wet; subject to frost heave.	Seasonal high water table; moderate to high shrink-swell potential; high compressibility; poor shear strength.	Seasonal high water table; clayey; poor stability upon thawing.	High	Low	Severe; seasonal high water table; slowly permeable, expansive, clayey material; filter fields saturated during wet periods.
Seasonal high water table; loses stability and flows when wet.	Seasonal high water table; low shrink-swell potential; slight compressibility; fair to good shear strength; subject to liquefaction and piping.	Seasonal high water table; fair stability upon thawing; wetness hinders operations.	Moderate	Low	Severe: seasonal high water table; filter fields saturated during wet periods.
Seasonal high water table.	Seasonal high water table; low shrink-swell potential; slight compressibility; good shear strength.	Seasonal high water table; high moisture content may exist and hinder operations; fair stability upon thawing.	Moderate	Low	Moderate: seasonal high water table; possible pollution of shallow water supplies; onsite investigation needed.
Seasonal high water table in some areas; substratum subject to frost heave.	Seasonal high water table in some areas; low to moderate shrink-swell potential; medium compressiblity; fair shear strength.	Seasonal high water table in some areas; high moisture content may exist and hinder operations; fair stability upon thawing.	Moderate	Low	Moderate: seasonal high water table in most areas; moderately slow permeability in the loamy substratum.
Seasonal high water table; clayey material below a depth of 18 to 40 inches is unstable, plastic, and subject to frost heave.	Seasonal high water table; high shrink-swell potential; high compressibility; poor shear strength.	Seasonal high water table; high moisture content often hinders operations; clayey subsoil has poor stability upon thawing.	High	Low	Severe: seasonal high water table; very slowly permeable, clayey material at a depth of 18 to 40 inches; onsite investigation needed.

TABLE 6.—*Engineering*

[Alluvial land (Au), Borrow pits (Bp), Lake beaches (La), Made land (Md), and Rough broken land (Ro) are not listed in this table. They made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this

Soil series and map symbols	Soil features affecting suitability for— Farm ponds: Reservoir areas	Farm ponds: Embankments
*Allendale: AeA, AhB, AlA, AtA. For Hoytville part of AhB, see Hoytville series; for Latty part of AlA, see Latty series; for Lenawee and Toledo parts of AtA, see Lenawee and Toledo series.	Seasonal high water table; sandy material, 18 to 40 inches thick, has rapid seepage; clayey substratum has very slow seepage; seal blanket required unless sandy material is removed.	In uppermost 18 to 40 inches, rapid seepage, poor stability, fair compaction, poor resistance to piping. At depth below 18 to 40 inches, slow seepage, fair to poor stability and compaction.
Avoca: AvA	Seasonal high water table; sandy material, 18 to 40 inches thick, has rapid seepage; clayey substratum has very slow seepage; seal blanket required unless sandy material is removed.	In uppermost 18 to 40 inches, rapid seepage, poor stability, fair compactibility, poor resistance to piping. At a depth below 18 to 40 inches, slow seepage, fair to poor stability and compaction.
Bach: Bc	Seasonal high water table; moderate seepage; suited to pit-type ponds; sides of pond unstable when wet.	Medium seepage; poor to fair stability and compaction; poor resistance to piping; erodible.
Blount: BlA, BlB	Seasonal high water table; slow seepage rate	Slow seepage rate; fair to good stability; poor to fair compaction characteristics.
Boyer: BrB	Rapid seepage in substratum; seal blanket required.	Medium seepage; poor to fair stability; fair to good compaction.
*Chelsea: CcB. For Croswell part, see Croswell series.	Rapid seepage; seal blanket required	Rapid seepage; poor stability; fair compaction; poor resistance to piping; difficult to vegetate.
*Conover: CvA, CvB, CwA. For Parkhill part of CwA, see Parkhill series.	Seasonal high water table; medium to slow seepage.	Slow seepage; fair to good stability and compaction.
Corunna: Cx	Seasonal high water table; medium seepage; suited to pit-type ponds.	Slow to medium seepage; fair to good stability and compaction; poor resistance to piping.
*Croswell: CyB. For Lamson part see Lamson series.	Rapid seepage; seal blanket required	Rapid seepage; poor stability; fair compaction; poor resistance to piping; difficult to vegetate.
Deford: De	Seasonal high water table; medium to rapid seepage; suited to pit-type ponds; sides of ponds unstable when wet.	Medium to rapid seepage; poor to fair compaction; poor resistance to piping; erodible.

interpretations for farm uses

are so variable that onsite investigation is needed. An asterisk in the first column indicates that at least one mapping unit in this series is reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil features affecting suitability for—Continued			
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Very slow permeability; clayey material at a depth below 18 to 40 inches; seasonal high water; surface and subsurface drainage needed.	Low available water capacity; very rapid water intake rate.	Not needed	Somewhat poorly drained; vegetation difficult to establish; low fertility; droughty.
Seasonal high water table; moderately slow permeability below a depth of 18 to 40 inches; wet depressions; random tile or surface drains needed.	Low available water capacity; very rapid water intake rate.	Not needed	Somewhat poorly drained; vegetation difficult to establish; low fertility; droughty.
Seasonal high water table; loamy very fine sand in substratum may flow into and plug tile; ditchbanks unstable; drainage needed.	Moderate available water capacity; rapid water intake rate; drainage needed.	Not needed	Not needed.
Slow permeability; seasonal high water table; depressions are wet and need surface drains; drainage generally needed.	High available water capacity; medium water intake rate.	Level to undulating relief with short slopes; irregularly shaped areas; difficult to vegetate and excavate because of clayey subsoil; diversions needed in some areas to intercept runoff from adjacent areas.	Somewhat poorly drained; slow to medium surface runoff; deep cuts expose clayey subsoil; vegetation difficult to establish; wetness limits crossing by equipment.
Not needed	Low available water capacity; rapid water intake rate.	Short slopes; small, irregularly shaped areas; moderately rapid permeability; subject to erosion.	Slow to medium surface runoff; vegetation difficult to establish; low fertility; droughty; erodible.
Not needed	Low available water capacity; very rapid water intake rate; frequent water applications needed; subject to soil blowing.	Not needed	Vegetation difficult to establish; low fertility; droughty.
Drainage needed in most places; moderately slow permeability; seasonal high water table; depressions are wet and need surface drains.	High available water capacity; medium water intake rate.	Level to gently undulating; short slopes; irregularly shaped areas; diversions needed in some areas to divert runoff from adjacent areas.	Somewhat poorly drained; slow to medium surface runoff; wetness limits crossing by equipment.
Drainage needed; seasonal high water table; moderately slow permeability at a depth of 20 to 40 inches; wet depressions; sandy pockets.	High available water capacity; rapid water intake rate; drainage required.	Not needed	Not needed.
Not needed	Low available water capacity; very rapid water intake rate; frequent water applications needed; subject to soil blowing.	Not needed	Undulating surface and many small, scattered, wet depressions make construction difficult; vegetation difficult to establish; low fertility; droughty.
Drainage needed; seasonal high water table; fine sand may flow into and plug tile; ditchbanks unstable.	Low available water capacity; rapid water intake rate; drainage required.	Not needed	Not needed.

TABLE 6.—*Engineering*

Soil series and map symbols	Soil features affecting suitability for—	
	Farm ponds	
	Reservoir areas	Embankments
Dighton. Mapped only in a complex with Miami soils.	Slow seepage to a depth of 20 to 40 inches, rapid seepage below; seal blanket required where sand substratum is exposed.	In uppermost 20 to 40 inches, slow seepage and fair to good stability and compaction. At a depth below 20 to 40 inches, rapid seepage, poor stability, fair compaction, poor resistance to piping.
Eastport: EaB, EaC	Rapid seepage; seal blanket required	Rapid seepage; poor stability; fair compaction; poor resistance to piping; difficult to vegetate.
Gilford: Gd	Seasonal high water table; rapid seepage; suited to pit-type ponds.	Medium to rapid seepage; poor to fair stability; fair to good compaction; poor resistance to piping.
Houghton: Ha	Seasonal high water table; rapid seepage; suited to pit-type ponds; flotation and caving of organic material likely.	Organic material is not suitable
Hoytville. Mapped only in complexes with Allendale and Nappanee soils.	Seasonal high water table; slow seepage; suited to pit-type ponds.	Slow seepage; fair to poor stability and compaction.
Jeddo: Ja	Seasonal high water table; slow seepage; suited to pit-type ponds.	Slow seepage; fair stability and compaction
Lamson: Ld	Seasonal high water table; subject to flooding in some areas; medium seepage; suited to pit-type ponds; sides of ponds unstable when wet.	Medium seepage; poor to fair stability and compaction; poor resistance to piping, erodible.
Latty: Le, LhA	Seasonal high water table; slow seepage; suited to pit-type ponds.	Slow seepage; poor to fair stability and compaction.
Latty, sandy subsoil variant: LlA	Seasonal high water table; slow seepage to a depth of 20 to 40 inches, rapid below; seal blanket required where sand substratum is exposed.	In uppermost 20 to 40 inches, slow seepage, poor to fair stability and compaction. At a depth below 20 to 40 inches, rapid seepage, poor stability fair compaction; poor resistance to piping.
Lenawee: Lm, LnA	Seasonal high water table; slow seepage	Slow seepage; poor to fair stability and compaction; poor resistance to piping.

interpretations for farm uses—Continued

Soil features affecting suitability for—Continued			
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Not needed	Moderate available water capacity; medium water intake rate; runoff and erosion on sloping areas.	Level to gently sloping; short slopes; irregularly shaped areas; moderate permeability; sandy underlying material at a depth of 20 to 40 inches.	Slow to medium surface runoff; subsoil difficult to vegetate and excavate.
Not needed	Very low available water capacity; very rapid water intake rate; frequent water application needed; subject to soil blowing.	Not needed	Very slow to medium surface runoff; difficult to vegetate, low fertility; very droughty.
Drainage needed; seasonal high water table; sandy substratum makes blinding necessary.	Low available water capacity; rapid water intake rate; drainage needed.	Not needed	Not needed.
Drainage needed; seasonal high water table; organic material is subject to subsidence if overdrained; controlled drainage desirable.	Very high available water capacity; very rapid water intake rate; drainage needed; subject to soil blowing.	Not needed	Not needed.
Drainage needed; slowly permeable; seasonal high water table; special blinding and close spacing of tile required; surface drainage needed.	Moderate available water capacity; slow water intake rate; drainage needed.	Not needed	Very poorly drained; dense, clayey subsoil hinders construction and establishment of vegetation; wetness limits crossing by equipment.
Subsurface and surface drainage needed; seasonal high water table; moderately slow permeability; depressions often wet.	High available water capacity; medium water intake rate; drainage needed.	Terraces not needed; diversions needed in some areas to divert runoff from adjacent areas.	Very poorly drained; risk of siltation; dense, clayey subsoil hinders construction and establishment of vegetation.
Drainage needed; seasonal high water table; silt loam and very fine sand in substratum may flow into and plug tile; ditchbanks unstable.	Moderate available water capacity; rapid water intake rate; drainage needed; some areas subject to flooding.	Not needed	Poorly drained; risk of siltation; wetness limits crossing by equipment; some areas subject to stream overflow.
Surface and subsurface drainage needed; very slow permeability; seasonal high water table; special blinding and close spacing of tile required.	Moderate available water capacity; slow water intake rate; drainage needed.	Terraces not needed; diversions needed in some areas to divert runoff from adjacent areas.	Generally very poorly drained, but somewhat poorly drained in 40 to 50 percent of LhA; dense, clayey subsoil hinders construction and establishment of vegetation.
Surface and subsurface drainage needed; seasonal high water table; very slow permeability in clayey material; special blinding and close spacing of tile needed.	Moderate available water capacity; slow water intake rate; drainage needed.	Terraces not needed; diversions needed in some areas to divert runoff from adjacent areas.	Very poorly drained; risk of siltation; dense, clayey subsoil hinders construction and establishment of vegetation.
Subsurface and surface drainage needed; seasonal high water table; moderately slow permeability; depressions often wet.	High available water capacity; medium water intake rate; drainage needed.	Terraces not needed; diversions needed in some areas to divert runoff from adjacent areas.	Generally poorly drained, but somewhat poorly drained in 30 to 40 percent of LnA; risk of siltation; wetness limits crossing with equipment.

TABLE 6.—*Engineering*

Soil series and map symbols	Soil features affecting suitability for— Farm ponds: Reservoir areas	Soil features affecting suitability for— Farm ponds: Embankments
Londo: LoA, LoB, LpA	Seasonal high water table; medium seepage	Slow seepage rate; fair stability and compaction.
*Metamora: MeA, MeB, MhA. For Parkhill part of MhA, see Parkhill series.	Seasonal high water table; medium to slow seepage.	Slow seepage rate; fair to good stability and compaction.
Metea: MlB	Rapid seepage to a depth of 18 to 40 inches, medium to slow below; seal blanket required unless sandy material is removed.	In uppermost 18 to 40 inches, rapid seepage, fair stability and compaction, difficult to vegetate. At a depth below 18 to 40 inches, slow seepage, fair to good stability and compaction.
*Miami: MmC, MnA, MnB. For Dighton part of MnA and MnB, see Dighton series.	Medium to slow seepage	Slow seepage; fair to good stability and compaction.
*Minoa: MoA, MoB, MsA. For Lamson part of MsA, see Lamson series.	Seasonal high water table; subject to flooding in some areas; medium seepage; sides of ponds unstable when wet.	Medium seepage; poor to fair stability and compaction; poor resistance to piping; erodible.
Minoa, clay substratum: MrA	Seasonal high water table; medium seepage in uppermost 30 to 50 inches, slow below; sides of ponds unstable when wet.	In uppermost 30 to 50 inches, medium seepage, poor to fair stability and compaction, poor resistance to piping, erodible. At a depth below 30 to 50 inches, slow seepage, poor stability and compaction.
Morley: MtC2, MtD2	Slow seepage	Slow seepage; fair to good stability and compaction.
Nappanee: NhA	Seasonal high water table; slow seepage	Slow seepage; poor to fair stability and compaction.
Otisco: OaA	Seasonal high water table; rapid seepage; seal blanket needed.	Rapid seepage; poor stability; fair compaction; poor resistance to piping.
Palms: Pa	Seasonal high water table; rapid seepage in upper 16 to 50 inches, slow below; suited to pit-type ponds; flotation and caving of organic material likely.	Organic material in the uppermost 16 to 50 inches is not suitable. Below a depth of 16 to 50 inches, slow seepage, poor to fair stability and compaction.

interpretations for farm uses—Continued

Soil features affecting suitability for—Continued			
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Drainage generally needed; moderate permeabillty; seasonal high water table; depressions need surface drains.	High available water capacity; medium water intake rate.	Level to gently undulating; short, irregular slopes; irregularly shaped areas; diversions needed in some areas to divert runoff from adjacent areas.	Somewhat poorly drained; slow to medium surface runoff; wetness limits crossing by equipment.
Drainage generally needed. Moderately slow permeability below a depth of 18 inches; seasonal high water table; depressional spots wet; random tile and surface drains needed.	Moderate available water capacity; rapid water intake rate.	Level to undulating; short, irregular slopes; limy, loamy materials at a depth of 18 to 40 inches.	Somewhat poorly drained; wetness limits crossing by equipment; some cobblestones and gravel.
Not needed	Low available water capacity; rapid water intake rate.	Not needed	Short, gentle slopes; vegetation difficult to establish; low fertility; droughty.
Not needed	High available water capacity; medium water intake rate; sloping areas subject to erosion.	Short irregular slopes; small irregularly shaped areas; subject to erosion.	Slow to rapid surface runoff; erodible.
Drainage needed in most places; seasonal high water table; suitable for tile if stream overflow is controlled; silty and fine sandy material may flow into and plug drainage tile; ditchbanks unstable.	Moderate available water capacity; rapid water intake rate; some areas subject to stream overflow.	Small areas that have short, irregular slopes.	Somewhat poorly drained; seepage spots; wetness limits crossing by equipment; some areas subject to stream overflow.
Drainage generally needed; seasonal high water table; silty and fine sandy material may flow into and plug drainage tile; ditchbanks unstable.	Moderate available water capacity; rapid water intake rate.	Small areas that have short, irregular slopes.	Somewhat poorly drained; seepage spots; wetness limits crossing by equipment.
Drainage generally not needed, but small wet areas may need random tile.	High available water capacity; medium water intake rate; sloping areas subject to erosion.	Short, irregular slopes; clayey subsoil that is difficult to vegetate and excavate; irregularly shaped areas; subject to erosion; diversions needed in some areas to protect adjacent lower areas.	Rapid surface runoff; clayey subsoil difficult to vegetate and excavate; erodible.
Surface and subsurface drainage needed; slow permeability; seasonal high water table; special blinding and close spacing of tile needed.	Moderate available water capacity; slow water intake rate; slow permeability.	Irregularly shaped areas that are very gently undulating; dense, clayey subsoil hinders construction and establishment of vegetation.	Seasonal high water table; dense, clayey subsoil hinders construction and establishment of vegetation; wetness limits crossing by equipment.
Drainage generally needed; sandy; rapid permeability; depressions; ditchbanks unstable.	Low available water capacity; rapid water intake rate; frequent water application needed.	Not needed	Somewhat poorly drained; vegetation difficult to establish; low fertility; droughty.
Drainage needed; seasonal high water table; organic material subsides if overdrained; controlled drainage desirable.	Very high available water capacity; very rapid water intake rate; drainage needed; subject to soil blowing.	Not needed	Not needed.

TABLE 6.—*Engineering*

Soil series and map symbols	Soil features affecting suitability for—	
	Farm ponds	
	Reservoir areas	Embankments
Parkhill: Pc	Seasonal high water table; slow seepage; suited to pit-type ponds.	Slow seepage; fair to good stability and compaction.
Paulding: Pa	Seasonal high water table; slow seepage; suited to pit-type ponds.	Slow seepage; poor stability and compaction; difficult to vegetate.
*Pert: PeB, PlB For Sims part of PlB, see Sims series.	Seasonal high water table; slow seepage	Slow seepage; fair to good stability; poor to fair compaction.
Pinconning: Pn	Seasonal high water table; rapid seepage in uppermost 18 to 40 inches, slow below; seal blanket needed unless sandy material is removed.	In uppermost 18 to 40 inches, medium to rapid seepage, poor to fair stability, fair compaction, poor resistance to piping, erodible. At a depth below 18 to 40 inches, slow seepage, poor stability and compaction.
Rousseau: RuB, RuC	Rapid seepage; seal blanket needed	Rapid seepage; poor stability; fair compaction; poor resistance to piping; difficult to vegetate.
Sanilac: SaA	Seasonal high water table; medium seepage; sides of ponds unstable when wet.	Medium seepage rate; poor to fair stability and compaction; poor resistance to piping; erodible.
Sims: Sm	Seasonal high water table; slow seepage; suited to pit-type ponds.	Slow seepage; fair to good stability and compaction.
Spinks: SpA, SpB	Rapid seepage; seal blanket needed	Rapid seepage; poor stability; fair compaction; poor resistance to piping; difficult to vegetate.
Spinks, loamy substratum: SsB	Rapid seepage rate in uppermost 42 to 66 inches, slow below; seal blanket needed unless sandy material is removed.	In uppermost 42 to 66 inches, rapid seepage, poor stability, fair compaction, poor resistance to piping, difficult to vegetate. At a depth below 42 to 66 inches, slow seepage, fair stability and compaction.
Thomas: Th	Seasonal high water table; slow seepage; suited to pit-type ponds.	Slow seepage; poor to fair stability and compaction; poor resistance to piping; erodible.
Tobico Mapped only in a complex with Wainola soils.	Seasonal high water table; rapid seepage; suited to pit-type ponds; sides of ponds unstable when wet.	Medium to rapid seepage; poor to fair stability; fair compaction; poor resistance to piping; erodible.

interpretations for farm uses—Continued

Soil features affecting suitability for—Continued			
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Surface and subsurface drainage needed; seasonal high water table; moderately slow permeability; depressions often wet.	High available water capacity; medium water intake rate; drainage needed.	Terraces not needed; diversions needed in some areas to divert runoff from adjacent areas.	Poorly drained; risk of siltation; wetness limits crossing by equipment.
Surface and subsurface drainage needed; very slow permeability; seasonal high water table; special blinding and close spacing of tile needed.	Moderate available water capacity; slow water intake rate; drainage needed.	Terraces not needed; diversions needed in some areas to divert runoff from adjacent areas.	Not needed.
Drainage generally needed; slow permeability; seasonal high water table; depressions are wet and need surface drains.	High available water capacity; medium water intake rate.	Irregularly shaped areas; seasonal high water table; dense, clayey subsoil; difficult to vegetate and construct.	Somewhat poorly drained; slow to medium surface runoff; dense clay subsoil; vegetation difficult to establish; wetness limits crossing by equipment.
Drainage needed; seasonal high water table; fine sand may flow into and plug tile; ditchbanks unstable.	Low available water capacity; rapid water intake rate; drainage needed.	Not needed.	Not needed.
Not needed.	Low available water capacity; rapid water intake rate; frequent water applications needed; subject to soil blowing.	Not needed.	Not needed.
Drainage needed; seasonal high water table; soil material may flow into and plug drainage tile; ditchbanks unstable.	Moderate available water capacity; rapid water intake rate.	Not needed.	Not needed.
Subsurface and surface drainage needed; seasonal high water table; slow permeability; depressions often wet.	High available water capacity; medium water intake rate; drainage needed.	Terraces not needed; diversions needed in some areas to divert runoff from adjacent areas.	Poorly drained; in many places occur as natural drainageways, subject to accumulation.
Not needed.	Low available water capacity; rapid water intake rate; frequent water applications needed, subject to soil blowing.	Level to gently undulating; short slopes; irregularly shaped areas; rapid permeability; diversions needed in some places to divert runoff from adjacent areas.	Vegetation difficult to establish; low fertility; droughty.
Not needed.	Low available water capacity; rapid water intake rate; frequent water applications needed; subject to soil blowing.	Not needed.	Difficult to vegetate; low fertility; droughty.
Subsurface and surface drainage needed; seasonal high water table; moderately slow permeability; depressions often wet; thin layers of silty material may plug tile.	High available water capacity; medium water intake rate; drainage needed.	Terraces not needed; diversions needed in some areas to divert runoff from adjacent areas.	Very poorly drained; risk of siltation; vegetation difficult to establish and maintain.
Drainage needed; seasonal high water table; very sandy substratum makes suitability for tiling questionable; wet depressions; ditchbanks unstable.	Very low available water capacity; rapid water intake rate; drainage needed.	Not needed.	Not needed.

TABLE 6.—*Engineering*

Soil series and map symbols	Soil features affecting suitability for—	
	Farm ponds	
	Reservoir areas	Embankments
Toledo: To	Seasonal high water table; slow seepage above substratum, variable below; suited to pit-type ponds.	Slow seepage; poor to fair stability and compaction.
*Wainola: WaA, WdA, WnA For Deford part of WdA, see Deford series; for Tobico part of WnA, see Tobico series.	Seasonal high water table; medium to rapid seepage; suited to pit-type ponds; sides of ponds unstable when wet.	Medium to rapid seepage; poor to fair stability; fair compaction; poor resistance to piping; erodible.
Wasepi: WoA	Seasonal high water table; medium seepage in uppermost 24 to 42 inches, rapid below; seal blanket needed if sand and gravel substratum is exposed.	In uppermost 24 to 42 inches, medium seepage rate, fair stability and compaction, poor resistance to piping. At a depth below 24 to 42 inches, rapid seepage, poor stability, fair compaction.
*Wasepi-Boyer complex, loamy substratum: WpB. For Boyer part, see Boyer series.	Seasonal high water table in some areas; medium to rapid seepage in uppermost 42 to 66 inches, slow below; seal blanket needed unless sandy material is removed.	In uppermost 42 to 66 inches, medium to rapid seepage, poor to fair stability, good compaction. At a depth below 42 to 66 inches, slow seepage, poor to fair stability and compaction.
Wasepi, clay subsoil variant: WsA	Seasonal high water table; medium to rapid seepage in uppermost 18 to 40 inches, slow below; seal blanket needed unless sandy material is removed.	In uppermost 18 to 40 inches, medium to rapid seepage, poor to fair stability, good compaction. At a depth below 18 to 40 inches, slow seepage, poor stability and compaction.

interpretations for farm uses—Continued

Soil features affecting suitability for—Continued			
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways
Surface and subsurface drainage needed; slow permeability; seasonal high water table; special blinding and close spacing of tile needed.	High available water capacity; slow water intake rate; drainage needed.	Terraces not needed; diversions needed in some areas to divert runoff from adjacent areas.	Very poorly drained; risk of siltation; dense, clayey subsoil hinders construction and establishment of vegetation.
Drainage needed; seasonal high water table; sandy material may flow into and plug tiles; ditchbanks unstable.	Low available water capacity; rapid water intake rate.	Not needed	Not needed.
Drainage needed in most places; seasonal high water table; sand and gravel substratum makes blinding of tile necessary.	Low available water capacity; rapid water intake rate.	Nearly level; shallow sandy soils over limy sand and gravel; diversions needed in some areas to divert runoff from adjacent areas.	Somewhat poorly drained; vegetation difficult to establish; low fertility; droughty.
Drainage needed in most places; seasonal high water table in most areas; sand and gravel substratum makes blinding of tile necessary.	Moderate available water capacity; rapid water intake rate.	Undulating; many, short, irregular slopes; slow to medium surface runoff; vegetation difficult to establish; low fertility; deep cuts expose limy sand and gravel.	Seasonally high water table in most areas; deep cuts expose sand and gravel; vegetation is difficult to establish.
Surface and subsurface drainage needed; very slow permeability; clayey material below a depth of 18 to 40 inches; seasonal high water table.	Moderate available water capacity; rapid water intake rate.	Diversions needed in some areas to divert runoff from adjoining areas.	Not needed.

2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating probable sources of sand, gravel, or rock suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational areas.

With the use of the soil map for identification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some words, for example, soil, clay, sand, gravel, and aggregate, have special meanings in soil science. These and other special terms that are used are defined in the Glossary. Specific values for engineering properties, such as shear strength or compressibility, should not be assigned to estimated values expressed in words in the tables. Information useful to engineers can also be obtained from the detailed soil map and other sections of the survey, particularly the sections "General Soil Map" and "Descriptions of the Soils."

The engineering data are presented in three tables. Table 4 lists all of the soil series in the county and provides estimates of soil properties significant in engineering; tables 5 and 6 list the soil series and mentions those characteristics that affect specified engineering practices. The estimates generally are to a depth of about 5 feet, and normally interpretations do not apply to greater depths.

The data in table 4 and the detailed soil map at the back of the survey can be used as a guide for evaluating the engineering properties of the soils in a specific part of the county. A detailed investigation at the site of the proposed construction is needed, however, because areas designated as a specific soil on the map may consist partly of areas of other soils too small to be shown on the published map. By comparing the soil description with the result of investigations at the site, the presence of an included soil generally can be determined.

Engineering classification systems

The United States Department of Agriculture system of classifying soil texture is used by agriculture scientists (*8*). In this system the textural class of a soil is based on the proportions of sand, silt, and clay in the soil.

The AASHO system is used by most highway engineers. In this system, the soil materials are placed in seven principal groups (*1*). The groups range from A–1, consisting of gravelly materials of high bearing capacity, to A–7, consisting of clay soils having low strength when wet.

The Unified soil classification system is preferred by some engineers. In this system, soil material is divided into 15 classes (*10*). Eight classes are for coarse-grained material (GW, GP, GM, GC, SW, SP, SM, SC); six classes for fine-grained material (ML, CL, OL, MH, CH, OH); and one class is for highly organic material (Pt).

Engineering properties of soils

In table 4 the soil series in the county and the map symbols for each are listed and estimates of some of the soil properties significant to engineering are given. The estimates are based on available test data and on field experience. Depth to bedrock is not shown because, in this county, bedrock is far enough below the surface to be no problem for most engineering purposes.

Depth to seasonal high water table refers to the shallowest depth to which the water table rises in winter and early in spring in soil that has not been artifically drained. This water table may be a perched one or an ordinary ground water table. If precipitation is less than normal during wet periods, the water table and the saturated soil are farther from the surface. Soil conditions immediately after heavy precipitation are not considered. In all soils, particularly those on side slopes and on uplands, the depth to the water table is generally greater late in spring, in summer, and in fall than the depth shown in table 4.

Depth from the surface normally is shown only for the major horizons, but other horizons are indicated if they have engineering properties significantly different from adjacent horizons. The depths shown are considered to be typical for the series, but in most areas there are variations of a foot or less both in the depth to and in the thickness of the various layers. All of the organic soils are classified on the basis of the uppermost 51 inches. Below this depth, the variation in texture and thickness of horizons is considerable.

Also given in table 4 are the textural classification of the U.S. Department of Agriculture, estimates of the Unified classification, and estimates of the classification used by the American Association of State Highway Officials (AASHO). The figures giving the percentages of material passing through sieves No. 4, No. 10, and No. 200 are rounded off to the nearest 5 percent. The percentage of material passing the No. 200 sieve approximates the combined amount of silt and clay in a soil.

The column showing permeability, or the rate at which water moves downward through undisturbed soil material, is estimated. The estimates, expressed in inches per hour, are based mainly on texture, structure, and consistence of the soils.

Available water capacity (also called available moisture capacity) is 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. In table 4 it is expressed as inches of water per inch of soil.

Reaction as shown in table 4 is the estimated range of pH values for each major horizon of the soils as determined in the field. It indicates the acidity or alkalinity of the soils. A pH of 7, for example, indicates a neutral soil, a lower pH value indicates acidity, and a higher value indicates alkalinity.

Shrink-swell potential refers to the change in volume of the soil that results from a change in moisture content. The estimates in table 4 are based mainly on the amount and kind of clay in a soil.

Engineering interpretations

Tables 5 and 6 give estimates of the suitability of the soils of the county for specified engineering uses and lists the soil properties that present hazards or limitations to those uses. The data in these tables apply to the representative profile of the soil series, which is described in the section "Descriptions of the Soils."

The suitability of the soils as a source of topsoil refers specifically to the use of soil material, preferably that which is rich in organic matter, as a topdressing for back slopes, embankments, lawns, gardens, and the like. The ratings are based mainly on the texture of the soil and the content of organic matter. Unless otherwise indicated, only the surface layer of a mineral soil is considered suitable as a source of topsoil.

The suitability of the soils as a source of sand and gravel refers to sources of such material that are within a depth of 5 feet from the surface. In some soils, however, the depth to sand and gravel is less than or greater than 5 feet, whereas in adjacent areas of the same soil unsuitable material can be just below 5 feet. Although some soils are rated as unsuitable for sand and gravel, these soils in places contain suitable material at a depth of more than 5 feet. Individual test pits are needed in such areas to determine the availability of sand and gravel.

The suitability of the soils as a source of road fill depends partly on the texture of the soil material. If the subsoil and substratum have contrasting characteristics, both are rated. Sand containing adequate binder generally is the most desirable material for road fill, and clay or organic material is the least desirable.

The entire soil profile was considered in determining the suitability of the soils as locations for highways. The features shown in tables 5 and 6 are for undisturbed soils without artificial drainage. Additional information can be obtained from data compiled by the State Highway Department of Michigan, which has rated the major soil series in the State as to their suitability for highway construction. This information is contained in the "Field Manual of Soil Engineering" (*4*).

Features that affect the suitability of undisturbed soils for foundations for buildings of no more than three stories are also shown in table 5. The suitability of the soils as a base of low buildings (fig. 13) depends mainly on characteristics of the substratum, which generally provides the base for foundations. Therefore the features shown are those of the substratum. Among the main factors considered in determining the suitability of the soils as foundations for low buildings is the shrink-swell potential. It can be determined for a specific horizon by referring to the column "Shrink-swell potential" in table 4.

The suitability of soils for winter grading deals with the ease or difficulty with which soil material can be handled and traversed by ordinary construction equipment during winter months. Limitations depend largely on the texture of the soil material, its natural content of water, and depth to the water table.

Corrosivity refers to the deterioration of underground conduits. Soil corrosion is that quality of the soil that results in destruction of uncoated steel pipes and concrete conduits. The soils are rated for both uncoated steel and concrete conduits. Generally, poor aeration and high values for acidity, electrical conductivity, salt content, and moisture content are characteristics of soils that are corrosive to metal conduits. Soils with a low value for acidity and a high moisture content are the most corrosive for concrete conduits.

***Figure 13.*—Foundation cracks caused by differential settling and sidehill creep. This area of Rough broken land is a poor site for building foundations.**

In determining the limitations of the soils for septic tank filter fields, the factors considered are depth to the water table, permeability rate, hazard of flooding, and topography. The rating of the soils is based on the limitations of the soil to absorb effluent. Soils are rated for three degrees of soil limitations: *slight*, relatively free of limitations or limitations are easily overcome; *moderate*, limitations need to be recognized but can be overcome with good management and careful design; *severe*, limitations severe enough to make use questionable.

Table 6 gives information that refers mainly to farm uses.

In determining the suitability of the soils for farm ponds, the entire soil profile is considered for both the reservoir area and for embankment material unless otherwise specified. The features shown for reservoir areas are those of undisturbed soils. Those shown for embankments are for disturbed soils. Features that affect the suitability of the soils for reservoirs and embankments are content of organic matter, permeability, shrink-swell potential, ground water level, and strength and stability.

Features that affect the suitability of the soils for agricultural drainage include soil texture, rate of water movement into and through the soil, depth to a restricting layer or to bedrock, depth to the water table, and position of the soil on the landscape.

The main factors to be considered in determining the suitability of the soils for irrigation are the available water capacity and the rate at which water moves into a soil. Also important are depth to the water table, depth to soil material that restricts growth of roots, and topography.

Features that affect the suitability of the soils for terraces and diversions are the texture of the soil, depth to soil material unsuitable for producing crops, and topography.

The features that affect the layout and construction of grassed waterways are the ease or difficulty in establishing vegetation in the waterways, the continued growth of the plants, and maintenance of waterways. Permeability, fertility, and the hazard of erosion are some of the main factors affecting the suitability of the soils for grassed waterways.

Use of Soils for Community Development

Community development and the accompanying extension of public utilities and establishment of business and recreational facilities create a need for soils information. This information is somewhat different from the information needed for farming. Land appraisers, realtors, city planners, builders, and others need facts that will help them to determine sites that are suitable for homes and other buildings and areas that are better for other uses. This section provides information for homeowners who want to landscape their property and to protect it against the erosion hazards of built-up communities.

Soil properties have an important effect on the suitability of a site for residential development, whether for a subdivision or an individual home. In planning, it is important to consider soil drainage, permeability, stability of the soil material, frequency of flooding, slope, and erosion hazard.

As slope becomes steeper, the hazards of erosion and of land slippage increase. Also, the layout and construction of streets and utilities become more difficult.

The Lamson, Latty, Lenawee, Parkhill, Toledo, and similar soils are poorly drained or very poorly drained and have a high water table unless artificially drained. Dry basements are difficult to maintain in these wet soils.

The section "Descriptions of the Soils" gives information on the drainage and other features of the soils. A high water table, even if only seasonal, hinders the proper function of septic tank filter fields and can result in unsanitary conditions.

The rate at which water moves downward through the soil influences the suitability for septic tank filter fields. Information regarding this feature is listed under the column "Permeability" in table 4. Sandy soils having rapid or very rapid permeability, such as Eastport and Spinks soils, may allow unfiltered effluent to enter and contaminate shallow water supplies. The column "Septic tank filter fields" in table 5 furnishes information about the limitations of the soils that affect their use for disposal of sewage.

Some soils provide good foundations for houses, whereas others do not. Information in the columns "Shrink-swell potential" in table 4 and "Foundations for low buildings" in table 5 will help in selecting soils that have the fewest limitations for foundations. The Boyer, Chelsea, Spinks, and similar soils provide good foundations. The Houghton and Palms soils have severe limitations for foundations because they contain unstable organic material. Alluvial land and other soils on bottom lands are subject to flooding and have severe limitations to use for houses (fig. 14).

Streets, driveways, and sidewalks

Of special interest to homeowners and developers is the suitability of the soils for streets, driveways, sidewalks, and patios. The Bach, Lamson, Minoa, and other soils that have a high silt content are subject to frost heave. Concrete cracks readily if placed on these soils without first covering the surface with sandy and gravelly material. Pavements and sidewalks crack and shift excessively if placed on the Latty, Paulding, and other soils that have a high water table or a high content of clay.

The poorly drained Houghton and Palms soils settle readily, especially after drainage. This settling causes cracking of pavements and an uneven surface. The columns "Shrink-swell potential" in table 4 and "Road fill" and "Highway location" in table 5 provide useful information about the use of soils for streets, driveways, and sidewalks.

Underground utility lines

Water mains, gas pipelines, communication lines, and sewer lines that are buried in the soil may corrode and break unless they are protected against certain electrobiochemical reactions. The reactions result from the inherent properties of the soil and differ according to the kind of soil.

All metals corrode to some degree if buried in the soil, and some metals corrode more rapidly in some soils than in others. The corrosion potential depends on physical, chemical, electrical, and biological characteristics of the soil; for example, oxygen concentration, concentration of anaerobic bacteria, and moisture content. Design and construction also have an influence. The likelihood of corrosion is intensified by connecting dissimilar metals, by burying metal structures at varying depths, and by extending pipelines through different kinds of soils.

In the Hoytville, Latty, Paulding, and similar soils that have a high shrink-swell potential, stresses that are created by volume changes can break cast-iron pipe. To prevent breakage, it may be necessary to cushion the pipes with sandy material. The column "Shrink-swell potential" in table 4 lists estimates of the volume changes of the soils on wetting and drying. The columns under "Corrosivity"

Figure 14.—Flooding in urban development on Alluvial land. Periodic flooding is a severe limitation for this use.

in table 5 give a general rating of the soils for corrosion potential.

Control of runoff and erosion

Erosion and the resulting accumulation of sediment are serious hazards in construction areas on sloping soils. Because of the compaction of soil material during construction and the increased surface covered by pavement, runoff from built-up areas may be 2 to 10 times as much as from land in farms or forest. The runoff concentrates in streets and gutters, instead of flowing into natural waterways, and the result is flooding and deposition of sediments in lower areas. Sloping areas of Miami and Morley soils (fig. 15) are especially subject to rapid runoff and severe erosion.

Some erosion control measures that help to protect small residential tracts are:

1. Locating driveways, walks, and fences on the contour, if possible, or straight across the slope.
2. Grading to make the surface level or gently sloping. The surface layer can be removed before grading and later used as topsoil.
3. Building diversions that intercept runoff and keep it from flowing over erodible areas.
4. Constructing or improving waterways to prevent the formation of gullies.
5. Draining seep areas and waterlogged areas with tile or by other means.

Table 5 provides information on features that affect use of the soils for diversions, grassed waterways, and artificial drainage.

Gardening and landscaping

Homeowners and landscape architects need to know the kinds of soil in an area so that flowers, shrubs, and trees suitable for landscaping can be selected.

An ideal soil for yard and garden plants is one that has a deep root zone, a loamy texture, a balanced supply of plant nutrients, an adequate amount of organic matter, adequate available water capacity, good drainage, and structure that allows free movement of water. The Miami soils closely approach this ideal soil.

The Boyer, Chelsea, and Spinks soils are sandy and droughty. During dry periods, lawns and shrubs dry up quickly on these soils unless they are watered frequently.

The very poorly drained soils, such as Latty and Paulding, are difficult to work when wet, and their surface dries out hard and cloddy. Seeding of lawns is difficult on these soils after they have been disturbed in construction.

The section "Management by Capability Units" gives information that is helpful for landscaping.

Public health

Soils data have many applications to public health problems, including those of sewage disposal, maintenance of a safe and adequate supply of water, and prevention of disease.

Sewage lagoons, septic tank systems, and sewer lines need to be located and constructed so that seepage or drainage from them cannot pollute water supplies. Leakage from sewage lagoons built of unsuitable soil material is one cause of pollution. The sandy Rousseau and Spinks soils have rapid permeability and may allow pollution. Wells, streams, and lakes can become contaminated by runoff from clogged filter fields, and rapid percolation of septic tank effluent can result in pollution of shallow underground water supplies. Table 5 gives information on each soil for embankments and septic tank filter fields. The soil map shows the major drainageways of the county and can be used as a general guide in locating filter fields.

In selecting sites for sanitary land fills, it is important to consider the topography and drainage of an area and the characteristics of the soils, including texture, permeability, reaction, and the nature of the underlying material. The soil map is helpful in locating sites and identifying the soils. Table 4 gives estimates of pertinent properties of the soils.

The stability of the soils is of major importance in the location of sewer lines. If the gradeline is interrupted, the sewer breaks down and a public health hazard results. Tables 4 and 5 provide information on shrink-swell potential and corrosion potential.

Mosquitoes, fleas, and other disease-carrying insects breed in stagnant water. By use of the soil map and the soil descriptions, it is possible to identify areas subject to flooding and areas likely to be ponded from time to time because the soils are nearly level or have poor internal drainage. After these possible trouble spots are located, the health hazard can be controlled by spraying to eliminate insects and by installing drainage systems to remove the standing water that attracts insects.

Recreation

Soil features, such as natural drainage, texture, slope, flooding hazard, and presence of stones and cobblestones, have an important effect on suitability of a site for recreation in St. Clair County.

The Bach, Deford, Hoytville, Latty, Parkhill, Toledo, and similar poorly drained or very poorly drained soils have severe limitations for most recreational uses. These soils are severely limited for use as campsites, picnic areas, and intensive play areas because of poor natural drainage and a high water table. The Houghton and Palms soils

Figure 15.—**Uncontrolled runoff and erosion on Morley loam, 6 to 12 percent slopes, eroded, cause sediment pollution in the Black River.**

especially have severe limitations for recreation because drainage is very poor and the organic material is unstable.

Sloping Eastport and Morley soils have severe limitations for recreation facilities other than paths and trails. Slopes hinder layout of campsites and placement of picnic tables, tents, trailers, and buildings. Level to gently sloping, well-drained soils, such as the Boyer, Metea, Rousseau, and Spinks soils, provide fair to good sites for campsites, picnic areas, intensive play areas, and buildings. These soils dry out quickly after rains and, therefore, provide firm surfaces for foot and vehicular traffic.

Alluvial land is limited in its use for recreation by a flooding hazard.

Poorly drained Gilford and Lamson soils, because of their high water table, are suited to pit-type ponds.

Formation and Classification of the Soils[5]

This section consists of two main parts. The first part tells how the factors of soil formation have affected the development of soils in St. Clair County. The second explains the system of soil classification and places each soil series in the various classes of the system.

Factors of Soil Formation

Soil is developed by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the parent material.

Climate, plants, and animal life are active factors of soil formation. They act on the parent material and slowly change it to a natural body of soil that has genetically related layers called horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme instances, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. In most places, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent material

Parent material is the unconsolidated mass from which a soil is formed. The parent material of the soils of St. Clair County was deposited by glaciers or by melt water from the glaciers. Some of this material has been reworked and redeposited by subsequent action of water and wind. From about 10,000 to 12,000 years ago, these glaciers covered the area that is now St. Clair County. Parent material determines the limits of the chemical and mineralogical composition of the soil. Although parent materials are of common glacial origin, their properties vary greatly, in some places within small areas, depending on how the materials were deposited. The dominant parent materials in St. Clair County were deposited as glacial till, outwash deposits, lacustrine deposits, and organic material.

Glacial till is material laid down directly by glaciers where water action is at a minimum. It consists of particles of different sizes that are mixed together. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water washing. The glacial till in St. Clair County is calcareous and friable or firm. Its texture is silt loam, silty clay loam, loam, clay loam, or clay. An example of soils formed in glacial till are those of the Morley series. These soils typically are moderately fine textured and fine textured and have well-developed structure.

Outwash materials are deposited by running water from melting glaciers. The size of the particles that make up outwash material varies according to the speed of the stream of water that carried them. When the water slows down, the coarser particles are deposited. Finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally consist of layers of particles of similar size. Sandy loam, sand, gravel, and other coarse particles are dominant. The Boyer soils, for example, formed in deposits of outwash material in St. Clair County.

Lacustrine materials are deposited in still, or ponded, glacial melt water. Because the coarser fragments drop out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remain to settle out in still water. Lacustrine deposits are silty or clayey. In St. Clair County, soils formed in lacustrine deposits are typically moderately fine textured and fine textured. The Latty series consists of soils formed in lacustrine materials.

Organic material is made up of deposits of plant remains. After the glaciers withdrew from the area, water was left standing in depressions of outwash, lake, and till plains. Grasses and sedges growing around the edges of these lakes died, and their remains fell to the bottom. Because of wetness of the areas, the plant remains did not decompose but remained around the edge of the lake. Later white-cedar and other water-tolerant trees grew in these areas. As these trees died, their residues became a part of the organic accumulation. The lakes were eventually filled with organic material and developed into areas of muck and peat. In some of these areas, the plant remains subsequently decomposed. In other of the areas, the material has changed little since deposition. The Houghton series consists of soils that formed in organic material.

Plant and animal life

Plants have been the principal organisms influencing the soils in St. Clair County, but bacteria, fungi, earthworms, and the activities of man also have been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kind

[5] R. W. JOHNSON, State soil scientist, and H. R. SINCLAIR, JR., assistant State soil scientist, Soil Conservation Service, helped prepare this section.

of plants that grew on the soil. The remains of these plants accumulate on the surface; they decay and eventually become organic matter. Roots of the plants provide channels for downward movement of water through the soil and also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The vegetation in St. Clair County was mainly deciduous forests. Differences in natural soil drainage and minor changes in parent material have affected the composition of the forest species.

In general, the well drained or moderately well drained soils on uplands, such as those in the Miami, Dighton, and Morley series, were mainly covered with oak, sugar maple, and beech. The Eastport soils were covered with oak, aspen, and white pine. The plants on the wet soils were primarily cedar, tamarack, elm, red maple, alder, willow, and aspen. A few wet soils also had sphagnum and other mosses, and these contributed substantially to the accumulation of organic matter. The Houghton and Palms series consist of soils that developed in wet areas and contain considerable organic matter. Thus, the soils of St. Clair County that developed under dominantly forest vegetation generally have less total accumulated organic matter than soils in other parts of the country that developed under dominantly grass vegetation.

Climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil. It determines the amount of water available for the weathering of minerals and the transporting of soil materials. Climate, through the influence on temperatures in the soil, determines the rate of chemical reaction that occurs in the soil. These influences affect large areas rather than a relatively small area, such as a county.

The climate in St. Clair County is cool and humid. This kind of climate presumably is similar to that which existed when the soils were forming. The soils in St. Clair County differ from soils that formed in a dry, warm climate or from those that formed in a hot, moist climate. Climate is uniform throughout the county, though its effect is modified locally by microrelief and proximity to large bodies of water. Therefore, the differences in the soils of St. Clair County, to a minor extent, are the result of the differences in climate.

Relief

Relief, or topography, has a marked effect on the soils of St. Clair County through its influence on natural drainage, erosion, plant cover, and soil temperature. In St. Clair County the soils range from level to strongly sloping. Natural soil drainage ranges from well drained on the ridgetops to very poorly drained in the depressions.

Relief influences the formation of soils by affecting runoff and drainage. Drainage, in turn, through its effect on aeration, determines the color of the soil. Runoff is greatest on the steeper soils, but in some low areas, it is temporarily ponded. Water and air move freely through soils that are well drained but move slowly through those that are very poorly drained. In soils that are well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized. In poorly aerated soils the color is a dull gray and mottled. The Miami series consists of well-drained, well-aerated soils, but the Thomas series consists of poorly aerated, very poorly drained soils.

Time

Time, usually a long time, is required by the agents of soil formation to develop distinct horizons in the soil from parent material. The differences in length of time that the parent materials have been in place are commonly reflected in the degree of development of the soil profile. Some soils develop rapidly, others slowly.

The soils in St. Clair County range from young to mature. The glacial deposits from which many of the soils formed have been exposed to soil-forming factors long enough to allow distinct horizons to develop in the soil profile. Some soils, however, have not been in place long enough for distinct horizons to develop.

The Sanilac series consists of young soils. In the Bach and Lamson series, the soils are examples of the effect of time on leaching of lime from the soil. The solum of the soils in the Bach and Lamson series had about the same amount of lime as the C horizon of these soils has today. The Bach soils were submerged under glacial lakes and protected from leaching. In contrast, the Lamson soils were above water and subject to leaching. The difference in length of time of leaching is reflected in the Lamson soils by the leaching of lime to a depth of 22 to 50 inches. On the other hand, the Bach soils are limy or calcareous at the soil surface.

Processes of Horizon Development

The development of the soil horizons from the unconsolidated parent material is called soil genesis. The physical, chemical, and biological properties of the various soil horizons are termed soil morphology.

Several processes were involved in the formation of horizons in the soils of St. Clair County. These processes are (1) accumulation of organic matter, (2) leaching of lime (calcium carbonate) and other bases, (3) reduction and transfer of iron, and (4) formation and translocation of silicate clay minerals. In most soils in St. Clair County, more than one of these processes have been active in the development of the horizons.

Organic matter has accumulated near the surface to form an A1 horizon. The A1 horizon is mixed into a plow layer (Ap horizon) when the soil is plowed. The soils of St. Clair County have a surface horizon ranging in organic-matter content from high to low. The Thomas series consists of soils that have high organic-matter content in the surface layer, but the Chelsea soils have a low organic-matter content.

Leaching of carbonates and other bases has occurred in most of the soils. Soil scientists generally agree that leaching of bases in soils usually precedes translocation of silicate clay minerals. Many of the soils are moderately to strongly leached, and this contributed to the development of horizons. For example, the Wasepi soils are leached of carbonates to a depth of 24 to 42 inches, but the Bach soils are limy or calcareous at the soil surface. The differences in the depth of leaching is a result of the effect of time as a soil-forming factor.

Reduction and transfer of iron, a process called gleying, is evident in the somewhat poorly drained to very poorly drained soils. The grayish color in the subsoil horizons indicates the reduction and loss of iron. Gilford soils show evidence of gleying and the reduction processes. Some horizons contain mottles and concretions and indicate a segregation of iron. This process has taken place in Allendale, Minoa, and Pert soils of St. Clair County.

In some soils the translocation of clay minerals has contributed to horizon development. The eluviated (leached) A2 horizon above the illuviated (accumulation) B horizon has a platy structure, is lower in content of clay, and in most places is lighter in color. The B horizon normally has an accumulation of clay (clay films) in pores and on surfaces of peds. Soils of this kind were probably leached of carbonates and soluble salts to a considerable extent before translocation of silicate clay took place. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation in the soils. The Morley soils are examples of soils having translocated silicate clays accumulated in the B horizon in the form of clay films.

In some soils of St. Clair County, iron, aluminum, and humus have moved from the surface layer to the B horizon. The Allendale, Avoca, Croswell, and Otisco soils are examples of soils having translocated iron, aluminum, and humus.

Classification of the Soils

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*7*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965 and supplemented in March 1967 and September 1968 (*9*). This system is under continual study, and readers interested in the development of the system should refer to the latest literature available.

The current system of classification defines classes in terms of observable or measurable properties of soils (*6*). It has six categories. Beginning with the most inclusive, the categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are measurable or observable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series, particularly in families, may change as more precise information becomes available.

Table 7 shows the classification of the soil series in St. Clair County according to the current system. Following are brief descriptions of the six categories.

Order.—Soils are grouped into orders according to properties that seem to have resulted from the same processes acting to about the same degree on the parent material. Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates. Six of the ten soil orders occur in this county. They are Entisols, Inceptisols, Mollisols, Spodosols, Alfisols, and Histosols.

Entisols are recent soils. They lack genetic horizons or have only the beginning of such horizons.

Inceptisols are most commonly on young but not recent land surfaces.

Mollisols have a thick, dark-colored surface layer, moderate to strong structure, and base saturation of more than 50 percent.

Spodosols have an iron-enriched and humus-enriched B horizon.

Alfisols have a clay-enriched B horizon and a base saturation of more than 35 percent.

Histosols have high organic-matter content. They developed in water from plant remains and some mineral matter.

Suborder.—Each order is divided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The soil properties used are mainly those that reflect either the presence or absence of waterlogging or differences in climate or vegetation. The climatic range of the suborders is narrower than that of the orders.

Great group.—Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major horizons and soil features. The horizons considered are those in which clay, iron, or humus has accumulated and those that have pans that interfere with the growth of roots or the movement of water. The features considered are the self-mulching properties of clays, soil temperature, chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

Subgroup.—Each great group is divided into subgroups, one representing the central (typic) segment of the group, and other groups, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other group, suborder, or order.

Family.—Families are established within a subgroup, primarily on the basis of properties that affect the growth of plants or the behavior of soils when used for engineering purposes. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

Series.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement of the profile. (See the section "How This Survey Was Made.")

General Nature of the County

This section provides information about the climate of the county and gives some important farming statistics. The statistics are from reports published by the United States Bureau of the Census.

Climate [6]

St. Clair County is not so strongly influenced by the Great Lakes as are many other counties in Michigan. This is because it is located in southeastern Michigan and is

[6] By NORTON D. STROMMEN, climatologist for Michigan, National Weather Service, U.S. Department of Commerce.

TABLE 7.—*Soil series classified according to the current system of classification*

Series	Family	Subgroup	Order
Allendale	Sandy over clayey, mixed, frigid	Aqualfic Haplorthods	Spodosols.
Avoca	Sandy over loamy, mixed, mesic	Entic Haplaquods	Spodosols.
Bach	Coarse-loamy, mixed, calcareous, mesic	Mollic Haplaquepts	Inceptisols.
Blount	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Boyer	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Chelsea	Mixed, mesic	Alfic Udipsamments	Entisols.
Conover	Fine-loamy, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Corunna [1]	Coarse-loamy, mixed, noncalcareous, mesic.	Typic Haplaquolls	Mollisols.
Croswell [2]	Sandy, mixed, frigid	Entic Haplorthods	Spodosols.
Deford	Mixed, frigid	Mollic Psammaquents	Entisols.
Dighton	Fine over sandy or sandy-skeletal, mixed	Typic Eutroboralfs	Alfisols.
Eastport [3]	Mixed, frigid	Spodic Udipsamments	Entisols.
Gilford [4]	Coarse-loamy, mixed, noncalcareous, mesic.	Typic Haplaquolls	Mollisols.
Houghton,	Euic, mesic	Typic Medisaprists	Histosols.
Hoytville	Fine, illitic, mesic	Mollic Ochraqualfs	Alfisols.
Jeddo	Fine, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Lamson [5]	Coarse-loamy, mixed, nonacid, mesic	Aeric Haplaquepts	Inceptisols.
Latty	Fine, illitic, nonacid, mesic	Typic Haplaquepts	Inceptisols.
Latty, sandy subsoil variant	Clayey over sandy or sandy skeletal, illitic, nonacid, mesic.	Mollic Haplaquepts	Inceptisols.
Lenawee	Fine, illitic, nonacid, mesic	Mollic Haplaquepts	Inceptisols.
Londo	Fine-loamy, mixed, mesic	Aeric Glossaqualfs	Alfisols.
Metamora	Fine-loamy, mixed, mesic	Udollic Ochraqualfs	Alfisols.
Metea	Fine-loamy, mixed, mesic	Arenic Hapludalfs	Alfisols.
Miami	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Minoa [6]	Coarse-loamy, mixed, mesic	Aquic Dystric Eutrochrepts	Inceptisols.
Morley	Fine, illitic, mesic	Typic Hapludalfs	Alfisols.
Nappanee [7]	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Otisco	Sandy, mixed, frigid	Entic Haplaquods	Spodosols.
Palms	Loamy, euic, mesic	Terric Medisaprists	Histosols.
Parkhill	Fine-loamy, mixed, nonacid, mesic	Mollic Haplaquepts	Inceptisols.
Paulding	Very fine, illitic, nonacid, mesic	Typic Haplaquepts	Inceptisols.
Pert	Fine, illitic, mesic	Aquic Hapludalfs	Alfisols.
Pinconning	Sandy over clayey, mixed, nonacid, frigid	Mollic Haplaquents	Entisols.
Rousseau	Sandy, mixed, frigid	Entic Haplorthods	Spodosols.
Sanilac	Coarse-loamy, mixed, calcareous, mesic	Aeric Haplaquepts	Inceptisols.
Sims	Fine, mixed, nonacid, frigid	Mollic Haplaquepts	Inceptisols.
Spinks	Sandy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
Thomas	Fine-loamy, mixed, calcareous, frigid	Histic Humaquepts	Inceptisols.
Tobico	Mixed, mesic	Mollic Psammaquents	Entisols.
Toledo	Fine, illitic, nonacid, mesic	Mollic Haplaquepts	Inceptisols.
Wainola	Sandy, mixed, frigid	Entic Haplaquods	Spodosols.
Wasepi [8]	Coarse-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Wasepi, clay subsoil variant	Coarse-loamy over clayey, mixed, mesic	Udollic Ochraqualfs	Alfisols.

[1] The Corunna soils in this county are taxadjuncts to the series because the epipedon is dominantly 10 inches or less in thickness.

[2] The Croswell soils in this county are taxadjuncts to the series because typically they have distinct mottles in the lower part of the spodic horizon.

[3] The Eastport soils in this county are taxadjuncts to the series because typically they lack an albic horizon underlain by a darker colored horizon.

[4] The Gilford soils in this county are taxadjuncts to the series because the epipedon is dominantly 10 inches or less in thickness.

[5] The Lamson soils in this county are taxadjuncts to the series because they are grayer throughout the control section than the defined range for the series.

[6] The Minoa soils in this county are taxadjuncts to the series because they have calcareous soil material less than 40 inches from the surface.

[7] The Nappanee soils in this county are taxadjuncts to the series because they have a thinner solum than the defined range for the series.

[8] The Wasepi soils in this county are taxadjuncts to the series because they are grayer throughout the control section than the defined range for the series.

bordered on the south by Lake St. Clair and on the northeast by Lake Huron. The most noticeable lake effect is the increased percentage of cloudiness observed late in fall and early in winter when prevailing westerly winds move cold air across the warmer lake water. But 5 to 10 percent more annual possible sunshine can be expected in St. Clair County compared to a similar location in the western part of Michigan.

Other data concerning the climate of St. Clair County are given in tables 8, 9, and 10.

According to weather records dating back to the 1870's, the highest temperature ever recorded at Port Huron was 104° F. on August 6, 1918, and the lowest was −25° on February 11, 1885. An average of 3 days in winter have temperatures falling to zero or lower. At the other temperature extreme, 100° or higher occurs in only about one summer out of five, and 90° or higher occurs on an average of 14 days during the summer.

The highest monthly mean temperature on record is 77.7° in July 1955, and the lowest is 10.8° in January 1912. The average date of the last freezing temperature in the spring is May 3, and the first in the fall is October 3.

Precipitation is heaviest during the growing months or crop season. It averages 59 percent of the annual total and occurs during the 6-month period of April through September. The greatest average monthly precipitation is 3.82 inches, and it occurs in June. The smallest average monthly precipitation is in January and is 1.75 inches. The greatest amount of precipitation ever received in a month was 10.61 inches in August 1956. In the driest month on record, February 1887, there was only a trace of precipitation. As much as 1.1 inches of precipitation in 1 hour,

TABLE 8.—*Temperature and precipitation*

[Data from Port Huron, St. Clair County, Mich., for the period 1938–67]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Number	Inches
January	30.2	17.0	43	0	1.75	0.3	3.7	17	3.5
February	33.3	17.9	44	1	1.92	1.5	3.4	15	4.4
March	42.4	25.6	60	12	2.11	.8	3.7	5	3.8
April	56.3	35.8	76	26	3.13	1.4	5.1	(1)	3.0
May	67.2	44.9	85	35	3.43	1.2	6.2	0	0
June	78.3	55.7	92	46	3.82	1.6	6.5	0	0
July	82.7	60.8	93	52	3.08	1.6	5.0	0	0
August	80.7	63.4	91	52	3.52	1.6	5.8	0	0
September	74.1	52.8	88	41	2.60	1.4	4.1	0	0
October	63.4	43.2	78	33	2.83	.9	5.2	(1)	2.0
November	47.9	32.9	62	21	2.61	1.1	4.4	2	2.7
December	35.4	22.6	47	6	2.24	.8	4.1	12	4.0
Year	57.7	39.4	[2] 96	[3] −4	33.01	23.8	42.8	51	3.98

[1] Less than one-half day.
[2] Average yearly maximum.
[3] Average yearly minimum.

TABLE 9.—*Probability of last freezing temperatures in spring and first in fall*

[Data from Port Huron, St. Clair County, Mich,. for the period 1938–67]

Probability	Dates for given probability and temperature [1]				
	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	March 30	April 6	April 22	May 4	May 18
2 years in 10 later than	March 25	April 1	April 17	April 29	May 13
5 years in 10 later than	March 15	March 22	April 7	April 19	May 3
Fall:					
1 year in 10 earlier than	November 16	November 6	October 27	October 14	September 30
2 years in 10 earlier than	November 23	November 13	November 3	October 21	October 7
5 years in 10 earlier than	December 2	November 22	November 12	October 30	October 16

[1] For the western section of St. Clair County, add 10 to 12 days to these dates in spring and substract 4 to 6 days in fall.

TABLE 10.—*Probability of selected snow depths at Port Huron, St. Clair County, Mich.*

Probability	Snow depths of [1]—			
	1 inch	3 inches	6 inches	12 inches
1 year in 2 earlier than	November 1	November 3	November 9	December 2
1 year in 10 earlier than	November 7	November 11	November 22	December 20
3 years in 10 earlier than	November 21	December 1	December 20	March 9
7 years in 10 earlier than	December 9	December 29	February 3	(2)
9 years in 10 earlier than	December 23	January 18	(2)	(2)
Average	November 30	December 15	January 2	January 5

[1] At time of daily observation.
[2] Probability of occurrence less than that given.

1.3 inches in 2 hours, and 2.2 inches in 24 hours falls about once in 2 years. In 24 hours, 3.3 inches fall about once in 10 years and 4.1 inches fall once in 50 years.

Evaporation data from the Dearborn station, about 60 miles southwest of St. Clair County, indicate an average evaporation total of 43.04 inches from April to October. This is nearly twice the normal rainfall total of 22.41 inches for the same 7-month period. Recharge of the soil water supply occurs during winter and early in spring. The capacity of the soil to hold this moisture to supplement the summer rainfall, when the water demands are high, is important for successful farming in this area.

Snowfall averages 38.4 inches a year, but it varies considerably from year to year. Totals in the past 30 years have varied from as much as 84.3 inches in the 1964–65 season to as little as 15.6 inches in the 1948–49 season. Measurable amounts of snow usually fall during each month from November through April.

Cloudiness is greatest late in fall and early in winter and is least late in spring and in summer. Detroit, which is the nearest 24-hour weather station, has records that show December averages 23 cloudy, 3 partly cloudy, and 5 clear days. July records show 8 cloudy, 12 partly cloudy, and 11 clear days.

Farming

The total land area of St. Clair County is about 473,600 acres. According to the 1964 U.S. Census of Agriculture, about 59 percent of this total area, or 279,813 acres, is in farms. The rest consists mainly of State land, privately owned woodland, abandoned farmland, urban, recreational, and industrial areas, and resorts. Of the area in farms in 1964, 147,016 acres were in harvested crops and 32,089 acres were cropland used only for pasture.

In 1964, 2,405 farms were in the county. Of these 554 were from 1 to 49 acres, 756 from 50 to 99 acres, 927 from 100 to 259 acres, 147 from 260 to 499 acres, and 20 from 500 to 999 acres. One was larger than 1,000 acres.

Of the 2,405 farms, 1,044 were miscellaneous or unclassified farms, 660 were dairy farms, 222 were poultry and livestock farms other than dairy, and 300 were cash grain farms. The remaining 179 farms were other field crops, vegetables, fruit and nuts, and general farms.

Corn is the chief row crop grown, and in 1964, 29,612 acres of corn were harvested for grain and 11,466 acres were cut for silage. Small grain also is important in the county, and in 1964, there were 21,289 acres of wheat, 19,282 acres of oats, and 2,747 acres of other grains. The acres of soybeans harvested amounted to 2,869. Of the hay crops harvested, 26,037 acres were alfalfa and alfalfa mixtures, 17,841 acres were clover and timothy or mixtures of clover, and 1,346 acres were other hay crops. Alfalfa, timothy, and red clover seed crops were grown on 1,727 acres, potatoes on 111 acres, beans on 5,994 acres, tree fruits, nuts, and grapes on 467 acres, vegetables harvested for sale on 2,777 acres, and sugar beets for sugar on 2,345 acres.

Of the forest products harvested for sale, there were 2,516 cords of firewood and fuelwood; 118,000 board feet of saw logs and veneer logs; and 7,090 Christmas trees.

Literature Cited

(1) AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS.
1961. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 8, 2 v., illus.

(2) BALDWIN, MARK, KELLOGG, CHARLES E., and THORP, JAMES.
1938. SOIL CLASSIFICATION. U.S. Dept. Agr. Ybk.: 979–1001, illus.

(3) LEMMON, PAUL E.
1968. GROUPING SOILS ON THE BASIS OF WOODLAND SUITABILITY. 3rd North Amer. Forest Soils Conf. Proc.: 413–426.

(4) MICHIGAN DEPARTMENT OF STATE HIGHWAYS.
1970. FIELD MANUAL OF SOIL ENGINEERING. Ed. 5, 474 pp., illus.

(5) MICHIGAN STATE UNIVERSITY.
1970. FERTILIZER RECOMMENDATIONS FOR VEGETABLES AND FIELD CROPS IN MICHIGAN. Ext. bul. E. 550, 24 pp.

(6) SIMONSON, ROY W.
1962. SOIL CLASSIFICATION IN THE UNITED STATES. Science 137: 1027–1034, illus.

(7) THORP, JAMES, and SMITH, GUY D.
1949. HIGHER CATEGORIES OF SOIL CLASSIFICATION: ORDER, SUBORDER, AND GREAT SOIL GROUP. Soil Sci. 67: 117–126.

(8) UNITED STATES DEPARTMENT OF AGRICULTURE.
1951. SOIL SURVEY MANUAL. U.S. Dept. Agr. Handbook 18, 503 pp., illus.

(9) ———
1960. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7TH APPROXIMATION. 265 pp., illus. [Supplements issued in March 1967 and September 1968]

(10) UNITED STATES DEPARTMENT OF DEFENSE.
1968. UNIFIED SOIL CLASSIFICATION SYSTEM FOR ROADS, AIRFIELDS, EMBANKMENTS AND FOUNDATIONS. MIL–STD–619B., 30 pp., illus.

Glossary

Acidity. See Reaction, soil.

Aeration, soil. The exchange of air in soil with air from the atmosphere.

Aggregate (soil structure). Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alkalinity. See Reaction, soil.

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.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: Clay coat, clay skin.

Concretions. Hard grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds that cement the soil grains together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed together in 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.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to the terrace grade.

Contour stripcropping. Growing crops in strips that follow the contour or are parallel to terraces or diversions. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. An arbitrary depth or thickness within a soil profile, designated for the purpose of soil classification. It is generally 40 inches for mineral soils and 51 inches for organic soils.

Cover crop. A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production.

Drainage, artificial. The removal of excess water on or within the soil by means of surface or subsurface drains.

Drainage, natural. Refers to the conditions 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. The following five different classes of natural drainage are recognized.

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 C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time; the water table is within 12 to 24 inches of the surface during part of the year; and mottlings are below 6 to 16 inches in the lower A horizon and in the B and C horizons. Synonymous with imperfectly drained, the term that has been used in Michigan.

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.

Fibric material. The least decomposed of the organic soil materials. It has very high amounts of plant fibers, which are well preserved and readily identifiable as to botanical origin; has very low bulk densities and high maximum water content when saturated.

Flood plain. Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

Free lime. The presence of accretions or concretions of lime, calcium carbonate, in soil material.

Glacial outwash (geology). Cross-bedded gravel, sand, and silt deposited by melt water as it flowed from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift con-consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gravel. Stone fragments consisting of rounded pebbles 2 millimeters to 3 inches in diameter.

Green manure. A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

Hemic material. Organic soil material that is intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material. It has features with intermediate values for fiber content, bulk density, and water content.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes.

Lacustrine (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of land.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Mapping unit, soil. Any soil, miscellaneous land type, or soil complex shown on the detailed soil map and identified by a symbol.

Mineral soil. Soil composed mainly of inorganic (mineral) material and low in content of organic matter. Its bulk density is greater than that of an organic soil.

Mottled. 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 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Muck. An organic soil consisting of fairly well decomposed organic material that is relatively high in mineral content, finely divided, and dark in color.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color that has a hue of 10YR, a value of 6, and a chroma of 4.

Organic soil. A general term applied to a soil or to a soil horizon that consists primarily of organic matter, such as peat soils, muck soils, and peaty soil layers.

Ortstein. The B horizon of soils that are cemented by the accumulated sesquioxides, by organic matter, or by both.

Parent material (soil). The horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability, soil. 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*.

Percolation. The downward movement of water through soil.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. See also Horizon, soil.

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. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff. The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff. That which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water. In this publication runoff is used in the sense of surface runoff.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 millimeter 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.

Sapric material. The most highly decomposed of the organic materials. It has the least amount of plant fiber, the highest bulk density values, and the lowest water content at saturation of the organic materials.

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 upon 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 millimeters 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).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil consists of the A and B horizons. Generally, the characteristics of the soil material in these horizons are unlike those of the underlying parent material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

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), *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 profile below plow depth.

Substratum. Any layer lying beneath the solum, or true soil; the C horizon.

Subsurface layer. As used in this report, refers to that part of the A horizon that occurs directly below the surface layer. It is leached of soluble minerals and clay.

Surface layer. As used in this report, refers to that part of the A horizon that occurs at the surface. This layer contains an accumulation of organic matter and generally is dark colored.

Texture, soil. The relative properties of sand, silt, and clay particles in a mass of soil. See also Clay, Sand, and Silt. The basic textural classes, in order of increasing proportions of fine particles, are as follows: *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."

Tile drain. Concrete or pottery pipe placed at suitable spacing and depths in the soil or subsoil to provide water outlets from the soil.

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.

Trace elements. The chemical elements found in soils in extremely small amounts, yet that are essential to plant growth. Some of the trace elements are zinc, cobalt, manganese, and copper.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

U.S. GOVERNMENT PRINTING OFFICE: 1974

Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at (800) 457–3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers. If you believe you experienced discrimination when obtaining services from USDA, participating in a USDA program, or participating in a program that receives financial assistance from USDA, you may file a complaint with USDA. Information about how to file a discrimination complaint is available from the Office of the Assistant Secretary for Civil Rights. USDA prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex (including gender identity and expression), marital status, familial status, parental status, religion, sexual orientation, political beliefs, genetic information, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.)

To file a complaint of discrimination, complete, sign, and mail a program discrimination complaint form, available at any USDA office location or online at www.ascr.usda.gov, or write to:

USDA
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, S.W.
Washington, DC 20250-9410

Or call toll free at (866) 632-9992 (voice) to obtain additional information, the appropriate office or to request documents. Individuals who are deaf, hard of hearing, or have speech disabilities may contact USDA through the Federal Relay service at (800) 877-8339 or (800) 845-6136 (in Spanish). USDA is an equal opportunity provider, employer, and lender.

Persons with disabilities who require alternative means for communication of program information (e.g., Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).