United States
Department of
Agriculture

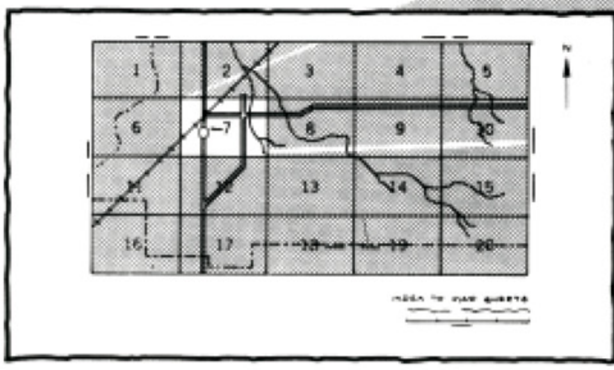
Soil
Conservation
Service

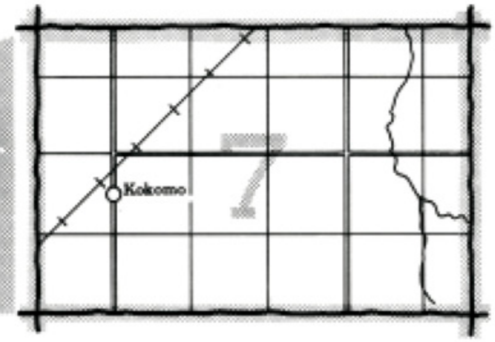
In cooperation with
Michigan Department
of Agriculture,
Michigan Agricultural
Experiment Station, and
Michigan Technological
University

Soil Survey of Tuscola County, Michigan

HOW TO USE

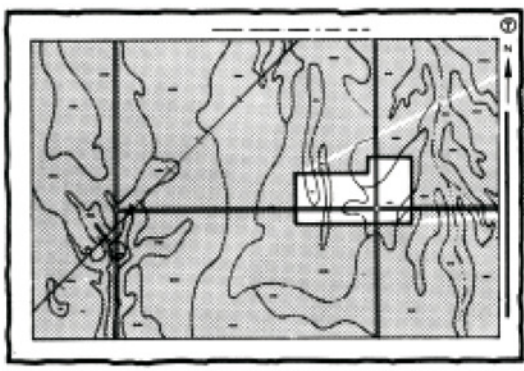
1. Locate your area of interest on the "Index to Map Sheets"

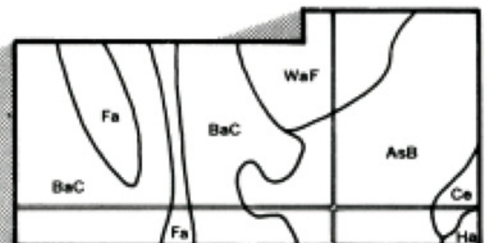




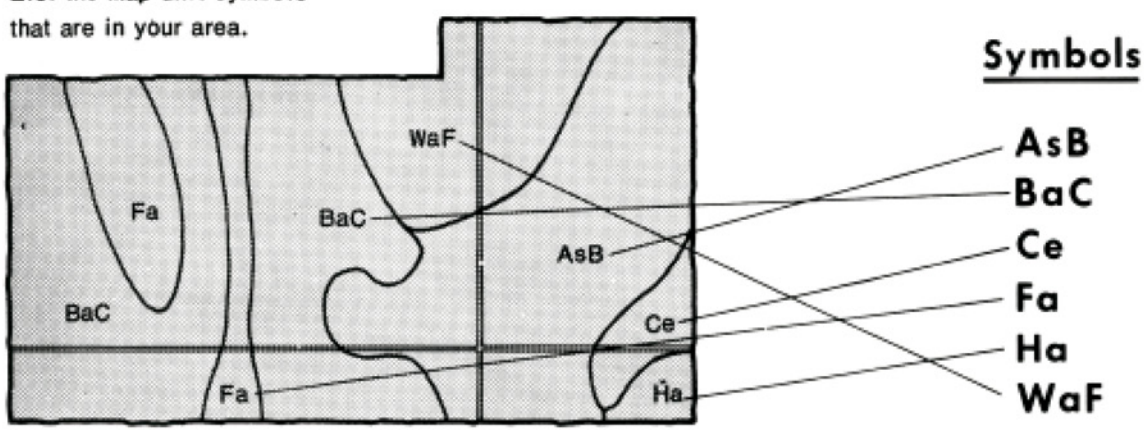
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



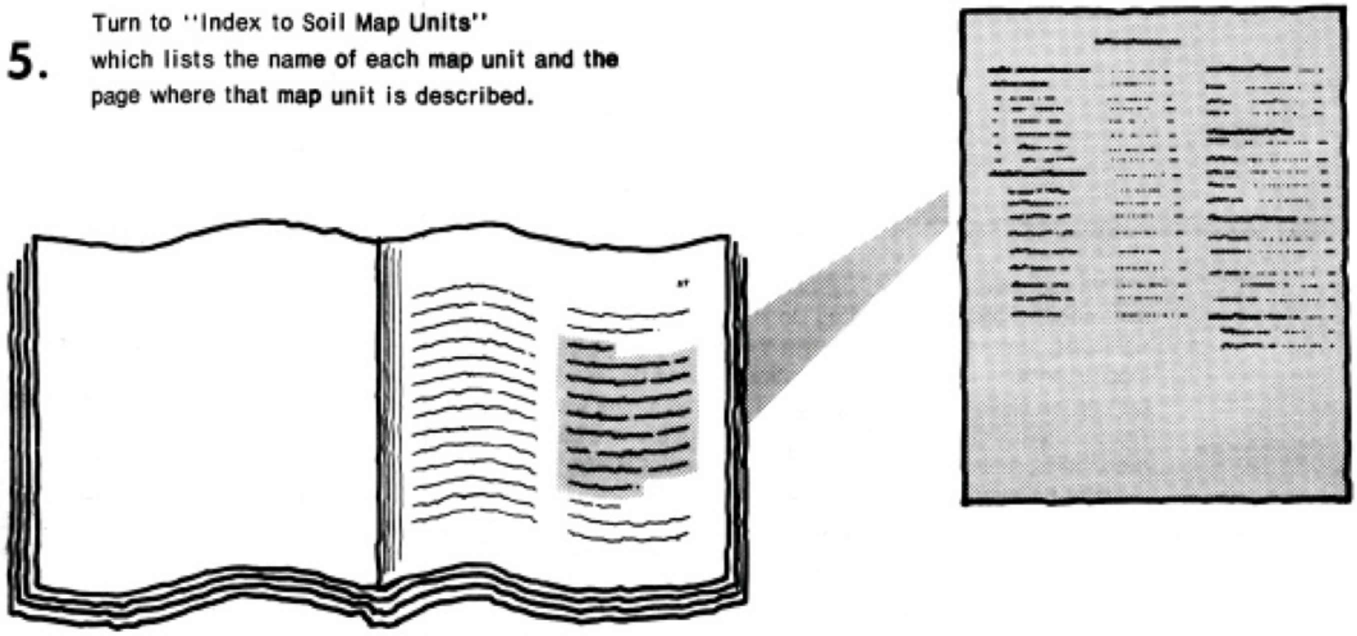


4. List the map unit symbols that are in your area.

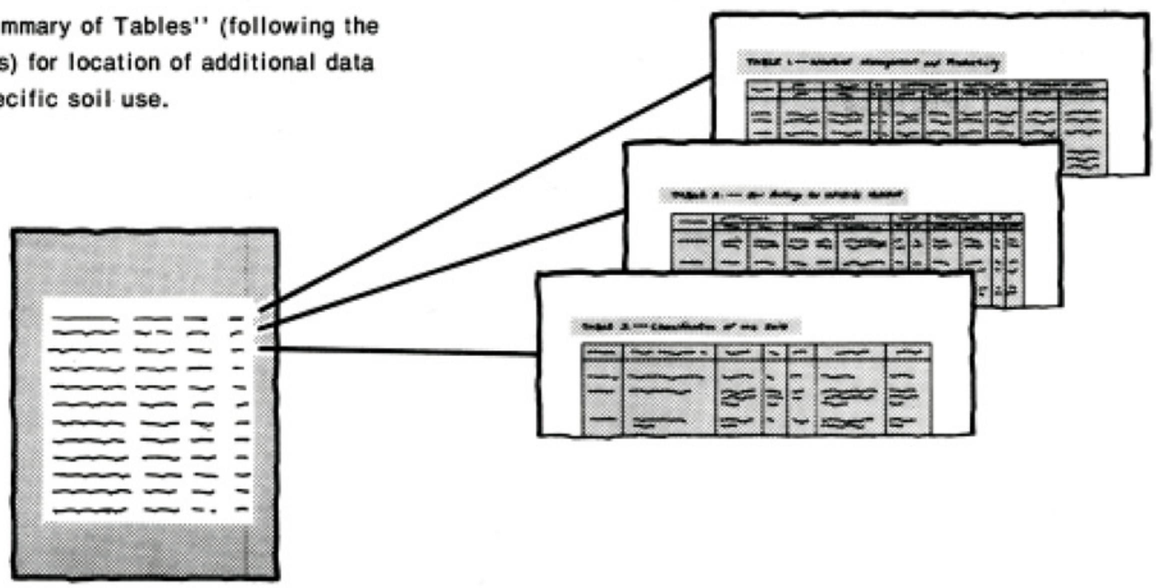


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service and the Michigan Department of Agriculture, the Michigan Agricultural Experiment Station and Michigan Technological University. It is part of the technical assistance furnished to the Tuscola County Soil Conservation District. Financial assistance was made available by the Tuscola County Board of Commissioners and by townships and cities in the county.

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

Cover: An area of the Tappan association used for hay and cash crops.

Contents

Soil Series

Issued September 1986

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Tuscola County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Holmer R. Hilner
State Conservationist
Soil Conservation Service

Location of Tuscola County in Michigan.

Soil Survey of Tuscola County, Michigan

By Wesley K. Mettert, Soil Conservation Service

Fieldwork by Wesley K. Mettert, Martin L. Kroell III, William E. Perkis, and Willard C. Ryland, Soil Conservation Service; Cheryl L. English and Craig Outwater, Michigan Department of Agriculture, Soil and Water Conservation Division; and Shawel Haile Marian, Michigan State University

United States Department of Agriculture, Soil Conservation Service, in cooperation with
Michigan Department of Agriculture, Michigan Agricultural Experiment Station, and Michigan Technological University

TUSCOLA COUNTY is in the east-central part of the Lower Peninsula of Michigan. It has a land area of 519,731 acres, or about 812 square miles. The population of the county in 1980 was 56,961, and that of Caro, the county seat, was 3,766.

Generally, the county is divided into four broad areas that are oriented northeast to southwest. The first of these, the southeastern part of the county, consists of undulating to hilly, loamy and sandy soils. Wet soils are in the numerous potholes and depressions. General livestock farming is dominant in this area. The second area lies between the first area and the Cass River. It is a broad area of nearly level to rolling, sandy soils. Most of these sandy soils are used as woodland or grassland. Many have been mined for sand. Several smaller areas of loamy soils throughout this sandy area are used as farmland. The third broad area consists of undulating to rolling, loamy soils north of the Cass River. These soils are used mainly for cash crops and livestock farming. The fourth broad area lies between the third area and Saginaw Bay. It consists of nearly level to undulating, loamy soils and some sandy soils. It is used primarily for cash crops.

The drainage basin of the Cass River includes the southern two-thirds of the county. A network of deep dredges drains the northwestern third of the county. The dredges drain into Saginaw Bay.

This soil survey updates the soil surveys of Tuscola County published in 1926 and 1974 (*3, 7*). It provides additional information and larger maps, which show the soils in greater detail.

General Nature of the County

This section gives general information concerning the county. It describes history and development; farming; climate; physiography, relief, and drainage; and natural resources.

History and Development

Philip S. Dakin, district conservationist, Soil Conservation Service, prepared this section.

The earliest known inhabitants of Tuscola County were the Sauk Indians, who resided in the area in the 1530's. They were later replaced by the Chippewa Indians, who practiced some farming.

The first permanent settler was Ebenezer Davis, who established a residence in the township of Tuscola in 1835. The first settlers were generally from New York. Expanded development of the county began in 1850. The county was part of Sanilac County until 1840. It was organized in 1850, and the State Legislature fixed the county seat at Vassar. After 6 years of deliberation, the county seat was moved to Centerville, presently Caro, in 1866 (*11*).

The early settlers cleared the forested areas for their homes and small farms. Settlements were established along the Cass River. Lumbering was the main occupation. Small sawmills were established in the early settlements, but most of the logs were floated down the Cass River and processed outside the county. White pine along the Cass River became known as "Cork Pine," which was a superior grade and in high demand by the world lumber market. The lumbering industry was at its peak in 1873. It gradually diminished as the woodland was converted to farmland (*10*).

Farming

Tuscola County was heavily forested when the early settlers arrived. Small farms were established within the forested areas. By the early 1850's, the county had 13 farms. The farm produce was sold to the lumbermen, and during the winter the farmers worked for these lumbermen.

After the Civil War, improved methods of agriculture and farm machinery were introduced and farming began to expand in the county. An agricultural society was organized. It kept agricultural records from 1866. In that year, the first county fair was held at Watrousville. The main crops displayed at the fair were wheat, corn, oats, and grasses. The yield of oats on these fertile lands was reported to be as high as 100 bushels per acre.

In 1871, a forest fire following a period of extreme drought caused damage, mainly to timber. It cleared the way for the expansion of farming. By 1880, there were 3,694 farms in the county. Wheat was the major crop for export. A second great fire occurred in 1881 as a result of another droughty period. It seriously damaged farms. Also, it marked an era of the gradual decline in lumbering and the expansion of cultivation.

In 1943, the Tuscola County Soil Conservation District was organized to assist landowners in controlling erosion and pollution. Currently, the county is one of the top agricultural areas in the United States. Farms make up about 359,000 acres, or 69 percent of the total land area. The major crops are corn, dry beans, wheat, sugar beets, soybeans, oats, and barley. The major livestock are dairy, beef, pork, and poultry. The high productivity of many of the soils and the climatic conditions ensure that agricultural products will continue to be the county's main economic base in the future.

Climate

Prepared by the Michigan Department of Agriculture, Climatology Division, East Lansing, Michigan.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Caro in the period 1951 to 1980. Table 2 gives data on precipitation as recorded at Sebewaing in the period 1951 to 1980. Table 3 shows probable dates of the first freeze in fall and the last freeze in spring. Table 4 provides data on length of the growing season.

In winter the average temperature is 23.5 degrees F, and the average daily minimum temperature is 15.2 degrees. The lowest temperature on record, which occurred at Caro on February 9, 1934, is -30 degrees. In summer the average temperature is 68.5 degrees, and the average daily maximum temperature is 82.1 degrees. The highest recorded temperature, which occurred at Caro on July 13, 1936, is 108 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 28.21 at Caro and 26 inches at Sebewaing. Of this, about 17 inches, or 60 percent, usually falls in April through September at Caro and 15.91 inches, or 61 percent, at Sebewaing. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14.4 inches at Caro and less than 13.3 inches at Sebewaing. The heaviest 1-day rainfall during the period of record was 3.20 inches at Caro on October 3, 1954, and 3.34 inches at Sebewaing on July 15, 1970. Thunderstorms occur on about 33 days each year at Caro and 32 days each year at Sebewaing.

The average seasonal snowfall is 36.5 inches at Caro and 33.8 inches at Sebewaing. The greatest snow depth at any one time during the period of record was 19 inches at Caro and 26 inches at Sebewaing. On the average, 61 days of the year have at least 1 inch of snow on the ground at Caro and 55 days at Sebewaing. The number of such days varies greatly from year to year.

At Caro, the heaviest 1-day snowfall on record was 14 inches, on January 27, 1967, and the greatest monthly snowfall was 25.3 inches, during January 1978. At Sebewaing, the greatest seasonal snowfall was 56.1 inches, during the winter of 1951-52, the least seasonal snowfall was 15.7 inches, during the winter of 1944-45, the greatest monthly snowfall was 31.3 inches, in February 1946, and the heaviest 1-day snowfall was 11.5 inches, on January 26, 1978.

According to data recorded at Flint, the average relative humidity in midafternoon is about 62 percent. Humidity is higher at night, and the average at dawn is about 81 percent. The prevailing wind is from the southwest. Average windspeed is highest, 12.1 miles per hour, in March. According to measurements made at Lansing, the sun shines 67 percent of the time possible in summer and 37 percent in winter.

Physiography, Relief, and Drainage

The dominant landforms in Tuscola County are a result of the Wisconsin Glaciation, the last glacial period. The recession of the part of the glacier that covered Michigan began about 12,000 years ago and ended about 6,000 years ago. As the ice melted, a mantle of glacial drift remained and various topographic features, such as terminal moraines, ground moraines, lake plains, and outwash plains, formed. The drift is the parent material of the soils in the county.

The northwestern part of the county is a nearly level lake plain. Bordering the lake plain is the nearly level to rolling Port Huron moraine. To the southeast of the moraine are areas of nearly level to rolling outwash plains and then nearly level and undulating ground moraines and more outwash plains. The Cass River flows to the southwest through these outwash plains and ground moraines. Other scattered outwash areas are throughout the county. Nearly level to steep interlobate moraines are in the southeastern part of the county. Most of the natural lakes and organic soils in the county are in or near this morainic system. They formed in depressions left by irregular glacial melt and the advances and retreats of the Saginaw and Huron lobes of the Wisconsin ice sheet.

The water table is within a depth of 6 feet during some part of the year in more than 80 percent of the county. Numerous manmade ponds and an extensive system of manmade drainageways are throughout the county.

Natural Resources

Natural resources have played an important part in the development of Tuscola County. In the past, a major resource was the lumber from most parts of the county. As the trees were removed, lumbering gave way to a great farming industry. Soil is currently the major natural resource in the county. It provides a growing medium for the grasses grazed by livestock and the crops produced on farms.

In some areas of the county, sand and gravel are mined for use in the construction of roads and buildings. Areas where the soils formed in fine sand are important sources of foundry sand and material for portland cement. Scattered brine wells and a few oil wells are in the northwestern part of the county. A few bituminous coal mines were mined in the 1940's. As the price of fuel escalates, these may be brought back into production.

How This Survey Was Made

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

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

Some of the boundaries on the general soil map of Tuscola County do not match those on the maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences result from modifications or refinements in soil series concepts and variations in the intensity of mapping or in the extent of the soils within the counties.

Soil Descriptions

Nearly Level Soils That Are Poorly Drained and Very Poorly Drained

Except for the Aquents, these soils are generally suited to cultivated crops, recreation uses, and woodland. Removing excess water and controlling ponding are management concerns.

These soils are poorly suited to sanitary facilities and building site development. Permeability and the depth to the water table are limitations. The Aquents are not suited to these uses because they are subject to ponding.

1. Essexville-Aquents-Tappan Association

Nearly level, poorly drained and very poorly drained, sandy and loamy soils on lake margins, beaches, till plains, and lake plains

This association makes up about 4 percent of the county. It is about 40 percent Essexville soils, 25 percent Aquents, 20 percent Tappan soils, and 15 percent soils of minor extent. The Aquents are in marshes along Saginaw Bay and in inland depressions and drainageways. The Essexville and Tappan soils are slightly higher on the landscape than the Aquents.

The Essexville soils are poorly drained. Typically, the surface layer is black, calcareous loamy fine sand about 12 inches thick. The subsoil is dark grayish brown, mottled, calcareous fine sand about 4 inches thick. The upper part of the substratum is pale brown and grayish brown, calcareous fine sand. The lower part to a depth of about 60 inches is brown and grayish brown, mottled loam.

The Aquents are very poorly drained and are ponded most of the year. They are dominantly loamy soils, but some areas are sandy.

The Tappan soils are poorly drained. Typically, the surface layer is very dark gray, calcareous loam about 11 inches thick. The subsoil is dark gray, mottled, calcareous loam about 8 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown, mottled, calcareous loam.

The soils of minor extent in this association are the somewhat poorly drained Avoca and Pipestone soils on low ridges and knolls.

Most areas of this association are used as cropland, recreation areas, or waterfowl habitat. The major soils generally are suitable as cropland, but the Aquents are unsuitable. Corn, potatoes, sugar beets, and beans are the main crops. Wetness is the major limitation affecting farm uses. Ponding is common in much of the association. The Essexville and Tappan soils have been drained or diked and drained.

The major soils generally are poorly suited to sanitary facilities and building site development because of wetness. The Aquents are unsuited to these uses because they are subject to ponding.

2. Tappan Association

Nearly level, poorly drained, loamy soils on lake plains and till plains

This association makes up about 5 percent of the county. It is about 80 percent Tappan soils and 20 percent soils of minor extent. The Tappan soils are on broad flats and in drainageways.

Typically, the surface layer of the Tappan soils is very dark gray, calcareous loam about 11 inches thick. The subsoil is dark gray, mottled, calcareous loam about 8 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown, mottled, calcareous loam.

The soils of minor extent in the Tappan association are the somewhat poorly drained Avoca, Londo, and Wixom soils and the poorly drained Essexville soils. Avoca and Londo soils are on low knolls and ridges. Essexville soils are more droughty than the Tappan soils. They are in landscape positions similar to those of the Tappan soils.

Most areas of this association have been drained and are used for cultivated crops, mainly corn, wheat, beans, and sugar beets. The suitability for cultivated crops is good.

Wetness is the main limitation (fig. 1). Ponding is common in the lowest areas.

The Tappan soils are poorly suited to sanitary facilities and building site development. Wetness is a severe limitation.

Nearly Level to Undulating Soils That Are Somewhat Poorly Drained to Very Poorly Drained

These soils are generally suitable for cultivated crops. Removing excess water during wet periods is a major management concern.

These soils are poorly suited to sanitary facilities and building site development. The depth to the water table is a major limitation affecting these uses.

3. Tappan-Londo-Avoca Association

Nearly level, poorly drained and somewhat poorly drained, loamy and sandy soils on lake plains, till plains, and moraines

This association makes up about 25 percent of the county. It is about 50 percent Tappan soils, 18 percent Londo soils, 14 percent Avoca soils, and 18 percent soils of minor extent. The Londo and Avoca soils are on flats and on low ridges and knolls. The Tappan soils are on low, broad flats and in drainageways.

The Tappan soils are poorly drained. Typically, the surface layer is very dark gray, calcareous loam about

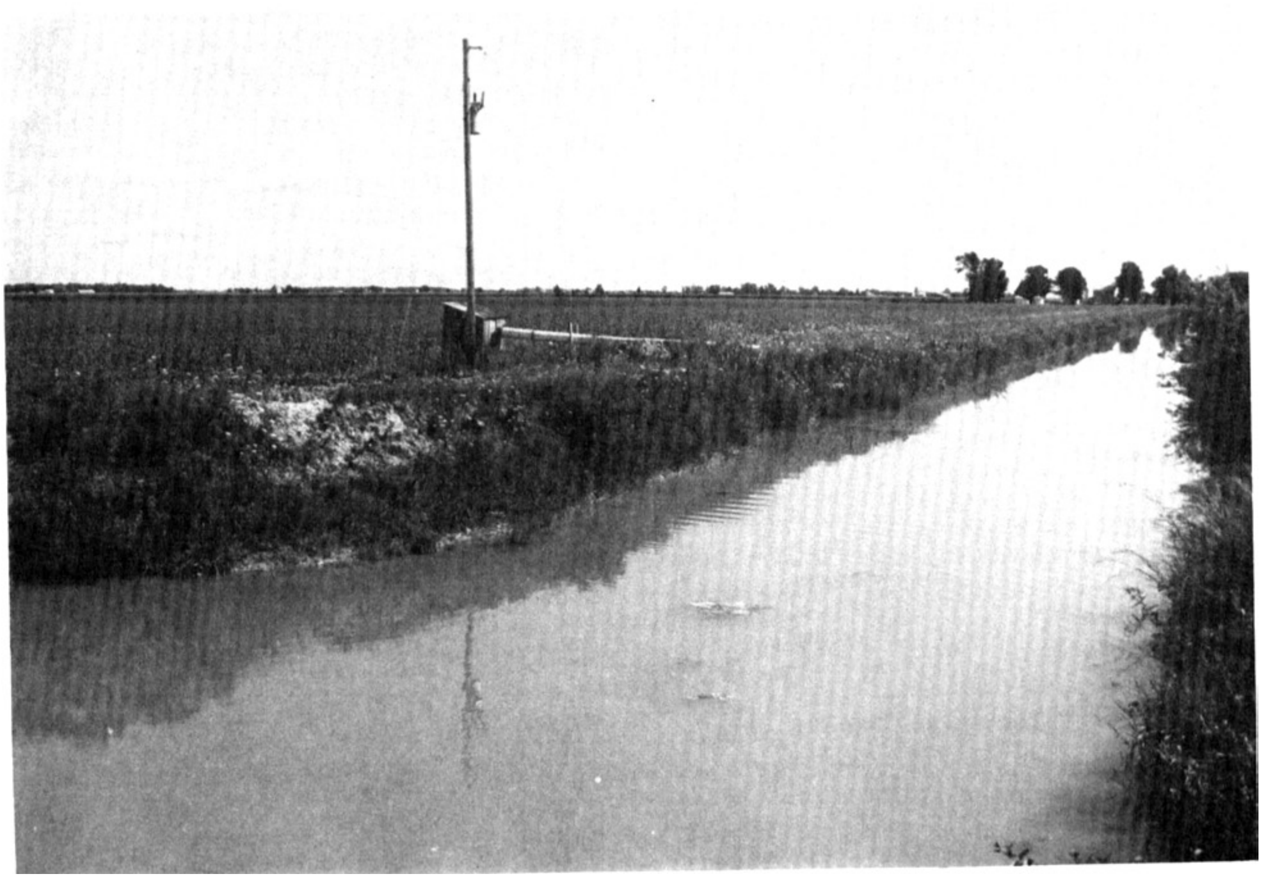


Figure 1.—An area of the Tappan association drained by a catchment and a lift pump.

11 inches thick. The subsoil is dark gray, mottled, calcareous loam about 8 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown, mottled, calcareous loam.

The Londo soils are somewhat poorly drained. Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is about 10 inches thick. It is mottled. The upper part is mixed dark yellowish brown loam and grayish brown sandy loam. The lower part is dark yellowish brown clay loam. The substratum to a depth of about 60 inches is dark yellowish brown and brown, mottled, calcareous loam.

The Avoca soils are somewhat poorly drained. Typically, the surface layer is dark brown loamy fine sand about 11 inches thick. The subsoil is dark brown, mottled loamy fine sand about 9 inches thick. The substratum to a depth of about 60 inches is brown, mottled, calcareous loam.

The soils of minor extent in this association are the moderately well drained Guelph soils, the somewhat poorly drained Shebeon soils, and the poorly drained Belleville and Gilford soils. Guelph soils are on ridges near drainageways. Shebeon soils are on broad plains. Belleville and Gilford soils are coarser textured than the Tappan and Londo soils. They are on low, broad flats and in depressions and drainageways.

Most areas of this association are used for cultivated crops, mainly corn, wheat, beans, and sugar beets. The suitability for cultivated crops is good. Wetness, compaction, and soil blowing are the major limitations affecting farm uses.

The major soils are poorly suited to sanitary facilities and building site development. Wetness is a severe limitation.

4. Metamora-Capac-Corunna Association

Nearly level to undulating, somewhat poorly drained and poorly drained, loamy soils on till plains and moraines

This association makes up about 3 percent of the county. It is about 30 percent Metamora soils, 22 percent Capac soils, 18 percent Corunna soils, and 30 percent soils of minor extent. The Metamora and Capac soils are in broad areas and on low knolls and ridges. The Corunna soils are on low flats and in depressions and drainageways.

The Metamora soils are nearly level and gently undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown sandy loam about 10 inches thick. The subsurface layer is yellowish brown, mottled sandy loam about 10 inches thick. The subsoil is dark yellowish brown, mottled loam about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled loam.

The Capac soils are nearly level to undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsoil is about 22 inches thick. The upper part is mixed dark yellowish brown and grayish brown loam. The lower part is dark yellowish brown, mottled clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous loam.

The Corunna soils are nearly level and poorly drained. Typically, the surface layer is very dark grayish brown sandy loam about 10 inches thick. The subsoil is mottled sandy loam about 23 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, mottled, calcareous loam.

The soils of minor extent in this association are the somewhat poorly drained Wixom soils and the poorly drained Belleville soils. These soils are coarse textured. Wixom soils are on low knolls and ridges. Belleville soils are in depressions and drainageways.

Most areas of this association are used for cultivated crops, mainly corn, wheat, and beans. A few areas are used as permanent pasture or woodland. The suitability for cultivated crops is good. Wetness is the main limitation affecting farm uses.

The major soils are poorly suited to sanitary facilities and building site development. Wetness is a severe limitation.

5. Wixom-Wolcott-Pipestone Association

Nearly level and gently undulating, somewhat poorly drained and very poorly drained, sandy and loamy soils on outwash plains, moraines, and till plains

This association makes up about 8 percent of the county. It is about 30 percent Wixom soils, 25 percent Wolcott soils, 15 percent the Pipestone soils that have a loamy substratum, and 30 percent soils of minor extent. The Wixom and Pipestone soils are on broad flats and on low ridges and knolls. The Wolcott soils are in low, broad areas and in depressions and drainageways.

The Wixom soils are nearly level and gently undulating and are somewhat poorly drained. Typically, the surface layer is very dark brown loamy fine sand about 9 inches thick. The subsoil is about 23 inches thick. The upper part is dark brown loamy fine sand and dark yellowish brown fine sand. The next part is brown, mottled fine sand. The lower part is dark yellowish brown sandy loam and grayish brown, mottled silty clay loam. The substratum to a depth of about 60 inches is gray and yellowish brown, mottled, calcareous silt loam.

The Wolcott soils are nearly level and very poorly drained. Typically, the surface layer is very dark gray loam about 11 inches thick. The subsoil is mottled loam about 21 inches thick. The upper part is olive gray, and the lower part is dark grayish brown. The substratum to a depth of about 60 inches is brown, mottled, calcareous loam.

The Pipestone soils are nearly level and gently undulating and are somewhat poorly drained. Typically, the surface layer is black fine sand about 6 inches thick.

The subsurface layer is grayish brown, mottled fine sand about 4 inches thick. The subsoil is about 35 inches thick. It is mottled. The upper part is very dark grayish brown fine sand and dark brown loamy sand. The lower part is dark yellowish brown fine sand. The substratum to a depth of about 60 inches is yellowish brown, mottled sand.

The soils of minor extent in this association are the somewhat poorly drained Capac soils and the poorly drained Belleville soils. Capac soils are finer textured than the Pipestone and Wixom soils. They are in landscape positions similar to those of the Pipestone and Wixom soils. Belleville soils are in landscape positions similar to those of the Wolcott soils.

Most areas of this association are used for cultivated crops, mainly corn and beans. The suitability for cultivated crops is fair. Wetness is the main limitation affecting farm uses. Soil blowing and the organic matter content are additional management concerns in areas of the Wixom and Pipestone soils.

The major soils are poorly suited to sanitary facilities and building site development. Wetness is a severe limitation.

Nearly Level to Rolling, Loamy Soils

These soils are generally suited to cultivated crops. If the soils are cultivated, water erosion is a hazard. Removing excess water during wet periods is a management concern in most areas.

The well drained soils are suitable as sites for most kinds of building site development. Slope is a limitation in some areas. The major soils are poorly suited to sanitary facilities because of permeability, the depth to the water table, and slope.

6. Guelph-Londo-Tappan Association

Nearly level to rolling, well drained to poorly drained, loamy soils on moraines and till plains

This association makes up about 12 percent of the county. It is about 60 percent Guelph soils, 20 percent Londo soils, 15 percent Tappan soils, and 5 percent soils of minor extent (fig. 2). The Guelph soils are mostly on ridges and knolls above the Londo and Tappan soils. The Londo soils are generally in the lower concave areas. The Tappan soils are on low lying flats and in depressions and drainageways.

The Guelph soils are nearly level to rolling and are moderately well drained or well drained. Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is loam about 15 inches thick. The upper part is dark brown and brown, and the lower part is dark brown. The substratum to a depth of about 60 inches is yellowish brown, calcareous loam.

The Londo soils are nearly level and somewhat poorly drained. Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is about 10 inches thick. It is mottled. The upper part is mixed dark yellowish brown loam and grayish brown sandy loam. The lower part is dark yellowish brown clay loam. The substratum to a depth of about 60 inches is dark yellowish brown and brown, mottled, calcareous loam.

The Tappan soils are nearly level and poorly drained. Typically, the surface layer is very dark gray, calcareous loam about 11 inches thick. The subsoil is dark gray, mottled, calcareous loam about 8 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown, mottled, calcareous loam.

The soils of minor extent in this association are the somewhat poorly drained Avoca, Wasepi, and Wixom soils; the poorly drained Belleville and Corunna soils; and the very poorly drained Gilford soils. All of these minor soils are coarser textured than the major soils. Avoca, Wasepi, and Wixom soils are in landscape positions similar to those of the Londo soils. Belleville, Corunna, and Gilford soils are in landscape positions similar to those of the Tappan soils.

Most areas of this association are used for cultivated crops, mainly corn, beans, wheat, and a legume-grass mixture. The suitability for cultivated crops is good or fair. Some areas are used as woodland or pasture. The wetness of the Londo and Tappan soils is the main limitation. Measures that help to control water erosion and overcome the slope are needed on the Guelph soils.

The Londo and Tappan soils are poorly suited to sanitary facilities and building site development because wetness is a severe limitation. The suitability of the Guelph soils for these uses is fair or poor. Slope and permeability are limitations.

Nearly Level and Gently Undulating, Loamy and Sandy Soils

These soils are generally suited to cultivated crops. If the soils are cultivated, removing excess water during wet periods and controlling water erosion and soil blowing are management concerns.

These soils are poorly suited to sanitary facilities and building site development. The depth to the water table and a poor filtering capacity are the main limitations.

7. Perrin-Wasepi-Gilford Association

Nearly level and gently undulating, moderately well drained, somewhat poorly drained, and very poorly drained, loamy and sandy soils on outwash plains, lake plains, and beaches

This association makes up about 10 percent of the county. It is about 35 percent Perrin soils, 30 percent Wasepi soils, 10 percent Gilford soils, and 25 percent soils of minor extent. The Perrin soils are mostly on ridges and knolls above the Wasepi and Gilford soils. The Wasepi soils are generally on the lower side slopes

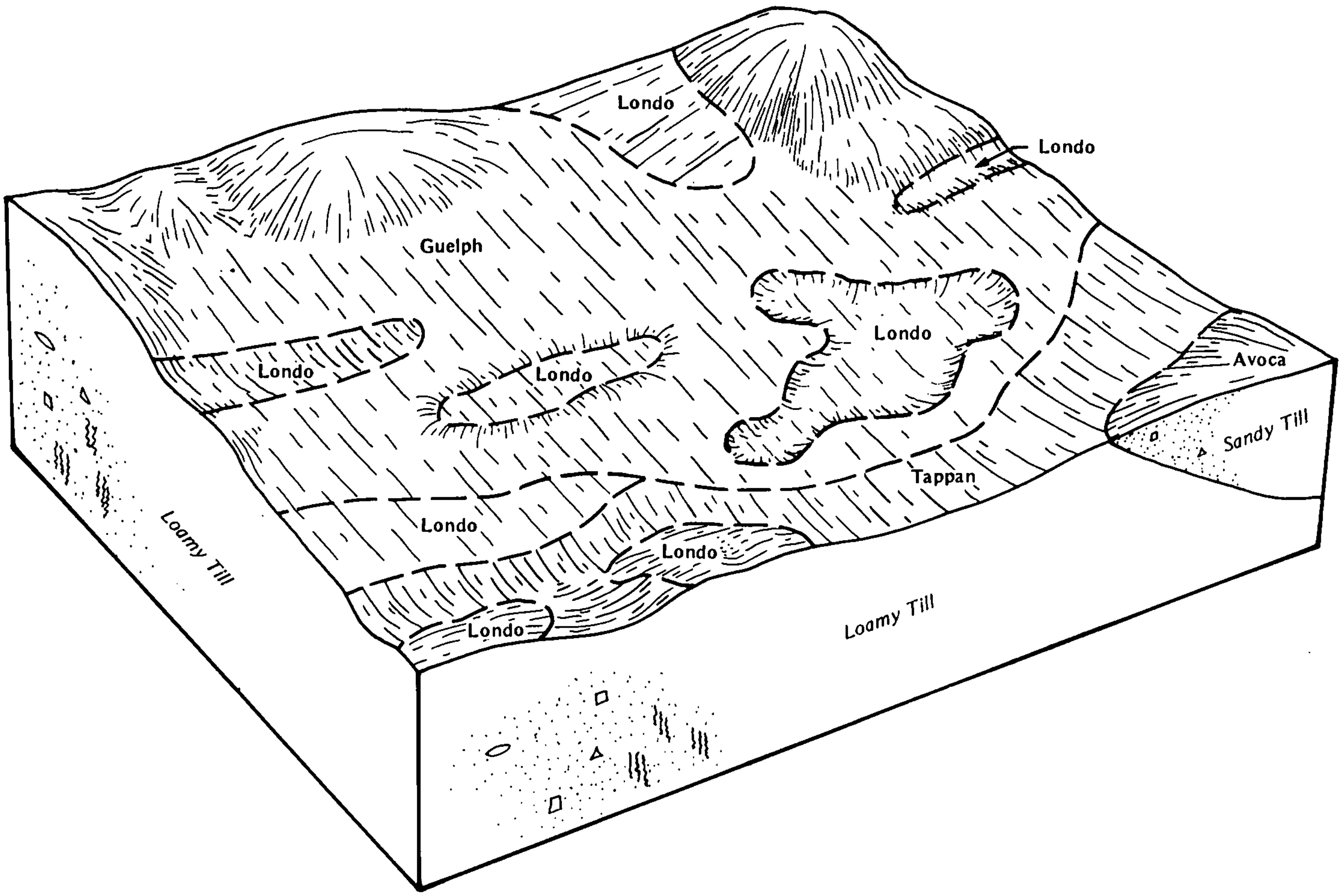


Figure 2.—Pattern of soils and parent material in the Guelph-Londo-Tappan association.

and on ridges. The Gilford soils are in low swales, depressions, and drainageways.

The Perrin soils are nearly level and gently undulating and are moderately well drained. Typically, the surface layer is dark grayish brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown loamy sand about 9 inches thick. The subsoil is dark brown, mottled fine sandy loam about 12 inches thick. The upper part of the substratum is pale brown sand. The lower part to a depth of about 60 inches is light yellowish brown, calcareous very gravelly sand.

The Wasepi soils are nearly level and somewhat poorly drained. Typically, the surface layer is very dark gray, calcareous sandy loam about 9 inches thick. The subsoil is mottled, calcareous sandy loam about 15 inches thick. The upper part is yellowish brown, and the lower part is dark grayish brown. The upper part of the substratum is dark grayish brown, mottled, calcareous loamy sand about 18 inches thick. The lower part to a depth of about 60 inches is yellowish brown, coarse sand and very gravelly sand.

The Gilford soils are nearly level and very poorly drained. Typically, the surface layer is black sandy loam about 11 inches thick. The subsoil is dark grayish brown, mottled, calcareous sandy loam about 18 inches thick. The substratum to a depth of about 60 inches is stratified grayish brown fine sand and dark grayish brown gravelly sand. It is calcareous.

The soils of minor extent in this association are the well drained Spinks and Boyer soils; the somewhat poorly drained Londo, Metamora, and Wixom soils; and the poorly drained Tappan soils. Spinks soils are slightly higher on the landscape than the Perrin soils. Londo, Metamora, and Wixom soils are less droughty than the major soils. They are in landscape positions similar to those of the Wasepi soils. Tappan soils are finer textured than the major soils. They are in landscape positions similar to those of the Gilford soils. In the southeastern part of Watertown Township, the well drained Boyer soils dominate this association. In places they are underlain by loamy or clayey material below a depth of 50 inches. They are slightly higher on the landscape than Perrin soils.

Most areas of this association are used as cropland or woodland. Some areas are mined for sand and gravel. The suitability for cultivated crops is fair. Corn, beans, and wheat are the main crops. The wetness of the Wasepi and Gilford soils is the main limitation affecting farm uses. Measures that help to control soil blowing, water erosion, and seasonal droughtiness are needed in areas of the Perrin soils.

The major soils are poorly suited to sanitary facilities because wetness and a poor filtering capacity are severe limitations. The suitability of the Gilford and Wasepi soils for building site development is poor, and that of the Perrin soils is fair or poor. The wetness is the main limitation.

Nearly Level to Gently Rolling, Sandy Soils

These soils are generally suited to cultivated crops. If the soils are cultivated, removing excess water and controlling soil blowing are management concerns.

These soils are poorly suited to sanitary facilities because of the depth to the water table and a poor filtering capacity. The suitability of these soils for building site development is good to poor. The depth to the water table and the slope are the main limitations.

8. Pipestone-Granby-Chelsea Association

Nearly level to gently rolling, somewhat poorly drained, poorly drained, and somewhat excessively drained, sandy soils on outwash plains, moraines, lake plains, and beaches

This association makes up about 16 percent of the county. It is about 40 percent Pipestone soils, 20 percent Granby soils, 16 percent Chelsea soils, and 24 percent soils of minor extent (fig. 3). The Chelsea soils are mostly on ridges and knolls above the Granby and Pipestone soils. The Pipestone soils are on broad flats, low knolls, and ridges. The Granby soils are on low, broad flats and in depressions and drainageways.

The Pipestone soils are nearly level and gently undulating and are somewhat poorly drained. Typically, the surface layer is black fine sand about 6 inches thick. The subsurface layer is grayish brown, mottled fine sand

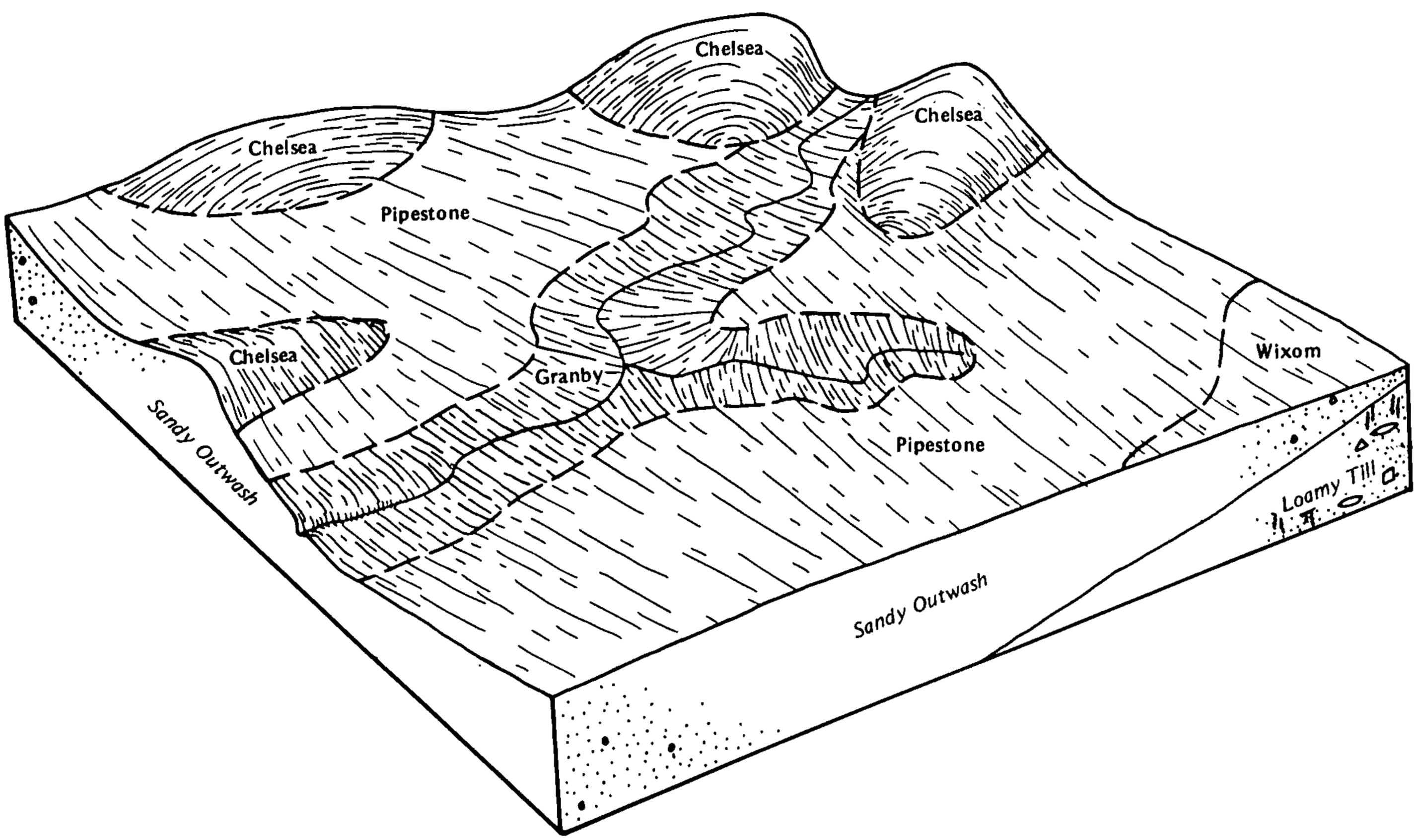


Figure 3.—Pattern of soils and parent material in the Pipestone-Granby-Chelsea association.

about 4 inches thick. The subsoil is about 35 inches thick. The upper part is very dark grayish brown, mottled fine sand; the next part is dark brown, mottled loamy sand; and the lower part is dark yellowish brown, mottled fine sand. The substratum to a depth of about 60 inches is yellowish brown, mottled sand.

The Granby soils are nearly level and poorly drained. Typically, the surface layer is black loamy fine sand about 11 inches thick. The subsoil is dark grayish brown, mottled loamy fine sand about 29 inches thick. The substratum to a depth of about 60 inches is olive brown and dark grayish brown, mottled fine sand.

The Chelsea soils are nearly level to gently rolling and are somewhat excessively drained. Typically, the surface layer is very dark grayish brown fine sand about 5 inches thick. The upper part of the subsoil is strong brown fine sand. The next part is yellowish brown fine sand. The lower part to a depth of about 60 inches is yellowish brown fine sand that has bands of dark yellowish brown loamy fine sand.

The soils of minor extent in this association are the somewhat poorly drained Wixom soils and the very poorly drained Wolcott soils. Wixom soils are in landscape positions similar to those of the Pipestone soils. Wolcott soils are in landscape positions similar to those of the Granby soils.

Most areas of this association are used for cultivated crops, pasture, or woodland. The suitability for cultivated crops is fair. The wetness of the Granby and Pipestone soils is the main limitation affecting farm uses. Soil blowing, organic matter content, and seasonal droughtiness are additional management concerns.

The major soils are poorly suited to sanitary facilities. The wetness of the Granby and Pipestone soils and a poor filtering capacity in all the major soils are limitations. The Granby and Pipestone soils are poorly suited to building site development because of the wetness. The Chelsea soils are well suited, but the slope can be a limitation.

Nearly Level to Steep, Loamy and Sandy Soils

The nearly level to gently rolling soils are generally suitable for cultivated crops. The rolling to steep soils are poorly suited or unsuited. Controlling water erosion and soil blowing and removing excess water are the main management concerns.

These soils are fairly well suited or poorly suited to sanitary facilities. Slope, the depth to the water table, permeability, and a poor filtering capacity are the major limitations. The suitability for building site development varies. The slope and the depth to the water table are the major limitations.

9. Marlette-Capac-Spinks Association

Nearly level to steep, well drained and somewhat poorly drained, loamy and sandy soils on moraines, outwash plains, and beaches

This association makes up about 15 percent of the county. It is about 42 percent Marlette soils, 15 percent Capac soils, 12 percent Spinks soils, and 31 percent soils of minor extent (fig. 4). The Marlette and Spinks soils are mostly on high ridges and knolls and in broad, undulating areas. The Capac soils are in the lower positions on the landscape.

The Marlette soils are gently undulating to steep and are well drained. Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part is mixed yellowish brown loam and grayish brown sandy loam, the next part is dark brown clay loam, and the lower part is brown loam. In the Marlette soils the substratum to a depth of about 60 inches is yellowish brown, calcareous loam.

The Capac soils are nearly level to undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The subsoil is about 22 inches thick. The upper part is mixed dark yellowish brown and grayish brown loam. The lower part is dark yellowish brown, mottled clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous loam.

The Spinks soils are nearly level to steep and are well drained. Typically, the surface layer is dark brown loamy fine sand about 7 inches thick. The subsurface layer is brown fine sand about 14 inches thick. The subsoil to a depth of about 60 inches is grayish brown and brown fine sand that has many thin bands of dark yellowish brown loamy fine sand.

The soils of minor extent in this association are the well drained Boyer and Metea soils, the somewhat poorly drained Metamora and Wixom soils, and the very poorly drained Wolcott soils. Boyer and Metea soils are in landscape positions similar to those of the Marlette and Spinks soils. Metamora and Wixom soils are in landscape positions similar to those of the Capac soils. Wolcott soils are on low, broad flats and in depressions and drainageways.

Most areas of this association are used for cultivated crops, pasture, or woodland. The suitability for cultivated crops is good to poor. Wetness, slope, water erosion, and soil blowing are the main limitations affecting farm uses. Measures that help to control water erosion on the Marlette soils and soil blowing on the Spinks soils and measures that remove excess water from the Capac soils are needed.

The major soils are fairly well suited or poorly suited to sanitary facilities. The slope, the depth to the water table, permeability, and a poor filtering capacity are limitations. The suitability for building site development is good to poor. The slope and the depth to the water table are the major limitations.

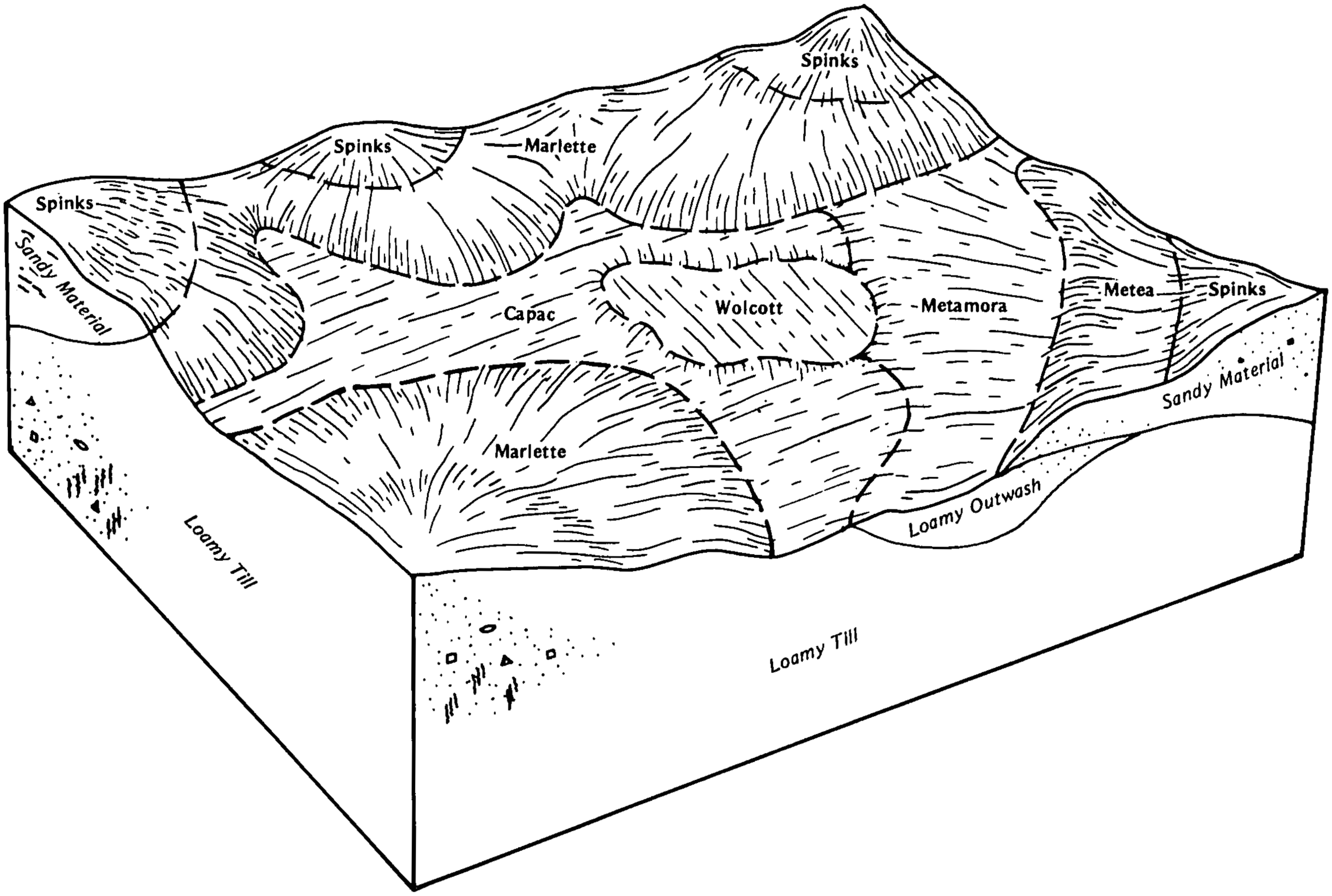


Figure 4.—Pattern of soils and parent material in the Marlette-Capac-Spinks association.

Nearly Level, Organic Soils

These soils are generally unsuited to cultivated crops, sanitary facilities, and building site development. Areas that can be adequately drained are suitable for crops. Removing excess water, preventing ponding, and providing adequate drainage outlets are management concerns.

10. Houghton-Adrian Association

Nearly level, very poorly drained, organic soils in bogs on moraines, till plains, and outwash plains

This association makes up about 2 percent of the county. It is about 30 percent Houghton soils, 30 percent Adrian soils, and 40 percent soils of minor extent. The Houghton and Adrian soils are in bogs and depressions and are on flood plains.

Typically, the Houghton soils are black muck to a depth of 51 inches or more.

Typically, the surface layer of the Adrian soils is black muck about 11 inches thick. The next layer also is black muck about 11 inches thick. The substratum to a depth of about 60 inches is yellowish brown and dark gray loamy fine sand.

The soils of minor extent in this association are the well drained Marlette soils, the somewhat poorly drained Capac and Pipestone soils, and the very poorly drained Wolcott soils. Marlette soils are on the steeper slopes. Capac and Pipestone soils are on low ridges, knolls, and the edges of depressions. Wolcott soils are along the borders of bogs and in drainageways.

Most areas of this association are used as woodland or wildlife habitat. Some are used for cultivated crops or pasture. The major soils are generally unsuited to cultivated crops, sanitary facilities, and building site development, mainly because they are subject to ponding.

Broad Land Use Considerations

More than 80 percent of Tuscola County is farmland, including pasture and woodland. The major land use is the production of crops for cash and livestock feed. Much of the farmland has been drained. Some of it is the best farmland in the state. The loamy, nearly level to undulating soils in associations 1 to 6 and in association 9 have good potential for farming. Some of the dominant soils in these associations are Tappan, Londo, Guelph, Marlette, Capac, and Wolcott soils. Wetness is the major limitation affecting farm uses on all of these soils, except for Guelph and Marlette soils. A drainage system can reduce the wetness. Large tracts of farmland are in associations 2, 3, 6, and 9. Small tracts of good farmland are in associations 4, 5, and 10.

If drained, the poorly drained or very poorly drained Belleville, Essexville, and Gilford soils in associations 1, 5, and 7 are suited to cucumbers, potatoes, and sweet onions. These soils generally have a thick, dark, sandy surface layer.

Areas where the soils have severe limitations for residential and other kinds of urban development are extensive. Large areas of the soils in associations 1, 2, 3, 4, 5, 7, 8, and 10 have a high water table, which severely limits building site development. The slope severely limits building site development on the gently rolling to steep soils in associations 6, 8, and 9. Extensive land shaping is needed.

A few of the less sloping areas of well drained and somewhat excessively drained soils in associations 6 to 9 can be developed for residential or other urban uses. Most of these soils, however, have better potential for farmland than the other soils in the county. This potential should not be overlooked when broad land uses are considered.

Most of the soils in the county have good or fair potential for woodland. Exceptions are the wetter soils and the organic soils in associations 7 to 10. On these soils, commercially valuable trees are less common and generally do not grow so rapidly as they do on well drained to somewhat poorly drained soils.

The sandy ridges in the areas of association 1 near Saginaw Bay and the gently rolling to hilly areas in associations 6, 8, 9, and 10 have good potential for parks and extensive recreation uses. Native hardwoods enhance the beauty of these areas. The undrained marshes and swamps throughout the county are suitable as nature study areas.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Marlette sandy loam, 6 to 12 percent slopes, is one of several phases in the Marlette series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Tappan-Avoca complex, 0 to 3 percent slopes, is an example.

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

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

Some of the boundaries on the detailed soil maps of Tuscola County do not match those on the maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences result from modifications or refinements in soil series concepts and variations in the intensity of mapping or in the extent of the soils within the counties.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

3A—Shebeon loam, 0 to 1 percent slopes. This nearly level, somewhat poorly drained soil is on broad flats. Individual areas are irregular in shape and range from 4 to several thousand acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 9 inches thick. The subsoil is brown, mottled, friable clay loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, mottled, firm and very firm, calcareous loam. In some areas the subsoil has less clay. In other areas the depth to very firm material is more than 40 inches.

Included with this soil in mapping are small areas of the poorly drained Tappan and somewhat poorly drained Sanilac soils. Tappan soils are in shallow depressions and drainageways. Sanilac soils do not have a firm substratum. They are in landscape positions similar to those of the Shebeon soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate or moderately slow in the upper part of the Shebeon soil and very slow in the lower part. Available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet during winter and spring. The root zone is restricted by the very firm substratum.

Most areas are used as cropland. This soil is well suited to corn, beans, winter wheat, and red clover. The major management concerns are wetness, compaction, and surface crusting. Shallow surface ditches are effective in removing excess water and allow fieldwork to be done earlier in the spring. Erosion-control structures may be needed where surface ditches and natural drainageways enter deep drainage ditches. Tilling when the soil is wet results in a cloddiness and compaction. As the soil structure is altered by compaction and excessive tillage, surface crusting becomes more severe. It can prevent seedling emergence and increase the runoff rate. Applying a system of conservation tillage, growing cover crops, and returning crop residue to the soil help to maintain tilth.

This soil is well suited to pasture. The major management concerns are wetness and compaction. Overgrazing or grazing when the soil is too wet causes surface compaction and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

Because of the seasonal high water table, this soil is poorly suited to building site development. It is well suited to sewage lagoons but is generally unsuited to septic tank absorption fields because of the seasonal high water table and the very slow permeability in the substratum. A surface or subsurface drainage system helps to lower the water table on sites for buildings. The buildings can be constructed on well compacted fill material, which raises the site.

The land capability classification is IIw. The Michigan soil management group is 2.5b-d.

4B—Covert sand, 0 to 6 percent slopes. This nearly level to undulating, moderately well drained soil is on broad flats, narrow ridges, and low knolls. Individual areas are elongated or irregularly shaped and range from 8 to 80 acres in size.

Typically, the surface layer is very dark grayish brown, very friable sand about 7 inches thick. The subsoil is loose sand about 34 inches thick. The upper part is dark yellowish brown and strong brown, and the lower part is brown and mottled. The substratum to a depth of about 60 inches is yellowish brown, mottled, loose sand. In places bands of loamy sand are in the substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone and Wixom soils and the excessively drained Chelsea soils. Pipestone and Wixom soils are in the lower positions on the landscape. Chelsea soils are in the higher positions. Included soils make up 3 to 15 percent of the unit.

Permeability is rapid in the Covert soil. Available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 2.0 to 3.5 feet during winter and spring.

Most areas of this soil are used as cropland or woodland. Some are used as permanent pasture.

Because of droughtiness and soil blowing, this soil is poorly suited to cropland. Corn, beans, spring grain, and legumes and grasses, however, can be grown. Irrigating, applying a system of conservation tillage, establishing windbreaks, returning crop residue to the soil, and growing winter cover crops help to overcome the low available water capacity and control soil blowing.

This soil is well suited to pasture. The major management concern is the droughtiness. During the summer months, when the soil does not have a sufficient amount of moisture, overgrazing can reduce the extent of the plant cover. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation and seedling mortality. The sandy surface layer can affect the trafficability of equipment during dry periods. Planting seedlings that can withstand droughty conditions, watering, and mulching decrease the seedling mortality rate. Replanting may be needed in some areas.

This soil is fairly well suited to building site development. The wetness is a limitation on sites for buildings with basements. These buildings can be constructed on well compacted fill material, which raises the site. A drainage system helps to lower the water table.

Because of the wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Special construction methods, such as filling or mounding with suitable material, are needed to raise the absorption field above the water table and to increase the filtering capacity. The soil is generally unsuited to sewage lagoons because of seepage.

The land capability classification is IVs. The Michigan soil management group is 5a.

6A—Tappan-Avoca complex, 0 to 3 percent slopes. This map unit consists of a nearly level, poorly drained Tappan soil and a nearly level, somewhat poorly drained Avoca soil. The Tappan soil is in sags, swales, and drainageways. It is subject to ponding. The Avoca soil is on low knolls and low ridges. Individual areas are irregular in shape and range from 10 to more than a thousand acres in size. They are about 45 to 60 percent Tappan and similar soils and 25 to 50 percent Avoca and similar soils. The soils occur as areas so small or so intricately mixed that mapping them separately is not practical.

Typically, the Tappan soil has a surface layer of very dark grayish brown, friable loam about 10 inches thick. The subsoil is mottled, friable, calcareous loam about 19 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is brown, friable, calcareous loam. In some places the surface layer is not calcareous. In other places the surface layer and subsoil are coarser textured.

Typically, the Avoca soil has a surface layer of dark brown, very friable loamy fine sand about 11 inches thick. The subsoil is dark brown, mottled, friable loamy fine sand about 9 inches thick. The substratum to a depth of about 60 inches is brown, mottled, friable, calcareous loam. In some places the depth to the substratum is more than 40 inches. In other places it is less than 18 inches.

Included with these soils in mapping are small areas of the poorly drained Belleville and somewhat poorly drained Londo soils. Belleville soils are more droughty than the Tappan soil. They are in landscape positions similar to those of the Tappan soil. Londo soils have a higher available water capacity than the Avoca soil. They are in landscape positions similar to those of Avoca soil. Included soils make up 10 to 20 percent of the unit.

Permeability is moderate or moderately slow in the upper part of the Tappan soil and slow in the lower part. It is rapid in the upper part of the Avoca soil and moderately slow in the lower part. Available water capacity is high in the Tappan soil and moderate in the Avoca soil. Surface runoff is slow to ponded on the Tappan soil and slow on the Avoca soil. From late in fall to spring, the seasonal high water table is near or above the surface of the Tappan soil and is at a depth of 0.5 foot to 1.5 feet in the Avoca soil. In some areas the surface layer of the Tappan soil contains free lime, which can cause phosphorus, manganese, and zinc deficiencies.

Most areas of these soils are farmed. Some are used as woodland.

These soils are well suited to corn, beans, winter wheat, and red clover. The major management concerns are wetness, ponding, tilth, soil blowing, and fertility. A surface and subsurface drainage system is needed to remove excess water. The sandy areas should not be overdrained. Some of these areas are droughty in midsummer. Soil blowing, compaction, and surface crusting can be controlled by applying a system of conservation tillage, establishing buffer strips, growing cover crops, and returning crop residue to the soil. Applying fertilizer in bands near the planted crops or as foliar spray improves fertility.

These soils are fairly well suited to pasture. The major management concern is the wetness. Also, compaction is a concern in some areas, and seasonal droughtiness is a limitation in the sandy areas. Grazing should be restricted during wet periods. Overgrazing the sandy areas can remove the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, rotation grazing, and restricted use during wet or very dry periods help to keep the pasture in good condition.

These soils are well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Operating planting and harvesting equipment is difficult during wet periods. Harvesting equipment should be used only when the soils are relatively dry or frozen. Planting seedlings that can withstand wet conditions reduces the seedling mortality rate. A shallow rooting depth caused by the seasonal high water table increases the windthrow hazard. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce this hazard.

Because of the wetness and the ponding, these soils are poorly suited to building site development. A surface or subsurface drainage system helps to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site. Proper design and careful construction help to keep water away from basements.

The Tappan soil is generally unsuited to septic tank absorption fields because of the ponding and the slow permeability. The Avoca soil is poorly suited because of the wetness and the moderately slow permeability. Special construction methods, such as filling or mounding with suitable material, can raise the absorption field above the water table in the Avoca soil. Both soils are poorly suited to sewage lagoons because of seepage, ponding, and wetness. Sealing the lagoon helps to prevent excessive seepage. Adding fill material to the berm around the lagoon helps to divert runoff water.

The land capability classification is IIw. The Michigan soil management groups are 2c-c and 4/2b.

8A—Tappan-Londo loams, 0 to 2 percent slopes. This map unit consists of a nearly level, poorly drained Tappan soil and a nearly level, somewhat poorly drained Londo soil. The Tappan soil is in drainageways and depressions and on flats. It is subject to ponding. The Londo soil is in the slightly higher landscape positions. Individual areas are broad and irregularly shaped and range from 10 to several thousand acres in size. They are about 40 to 60 percent Tappan and similar soils and 25 to 55 percent Londo and similar soils. The soils occur as areas so small or so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Tappan soil is very dark gray, calcareous, friable loam about 11 inches thick. The subsoil is dark gray, mottled, friable, calcareous loam about 8 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown, mottled, firm, calcareous loam. In some places the subsoil is not calcareous. In other places the surface layer and subsoil are coarser textured.

Typically, the surface layer of the Londo soil is dark grayish brown, friable loam about 10 inches thick. The subsoil is about 10 inches thick. The upper part is dark yellowish brown, friable loam mixed with coatings of grayish brown, very friable sandy loam. The lower part is dark yellowish brown, mottled, firm loam. The substratum to a depth of about 60 inches is dark yellowish brown and brown, mottled, friable, calcareous loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Avoca soils. These included soils are more droughty than the Londo soil. They are in landscape positions similar to those of Londo soil. They make up 5 to 10 percent of the unit.

Permeability is moderate or moderately slow in the upper part of the Tappan soil and slow in the lower part. It is moderate or moderately slow in the Londo soil. Available water capacity is high in both soils. Surface runoff is slow to ponded. From late in fall to spring, the seasonal high water table is near or above the surface of the Tappan soil and is at a depth of 1 to 2 feet in the Londo soil. The surface layer of the Tappan soil contains free lime, which can restrict the availability of phosphorus, manganese, and zinc.

Most areas of these soils are farmed (fig. 5). Some are used as woodland.

These soils are well suited to corn, wheat, beans, sugar beets, and alfalfa. The major management concerns are wetness, compaction, and fertility. Both surface and subsurface drainage systems are needed to reduce the wetness (fig. 6). Working the soils when they are too wet results in cloddiness and compaction. Compaction inhibits root development. As the soil structure is destroyed by compaction and excessive tillage, surface crusting becomes more severe. Applying a system of conservation tillage, growing cover crops, and returning crop residue to the soil help to maintain tilth. Applying fertilizer in bands near the planted crops or as foliar spray improves the fertility of the Tappan soil.

These soils are fairly well suited to pasture. The major management concerns are wetness and compaction. Overgrazing or grazing when the soils are wet causes compaction of the surface layer and destroys the cover of forage plants. Proper stocking rates and rotation or strip grazing during wet periods help to keep the pasture in good condition.

Figure 5.—Sugar beets in an area of Tappan-Londo loams, 0 to 2 percent slopes.

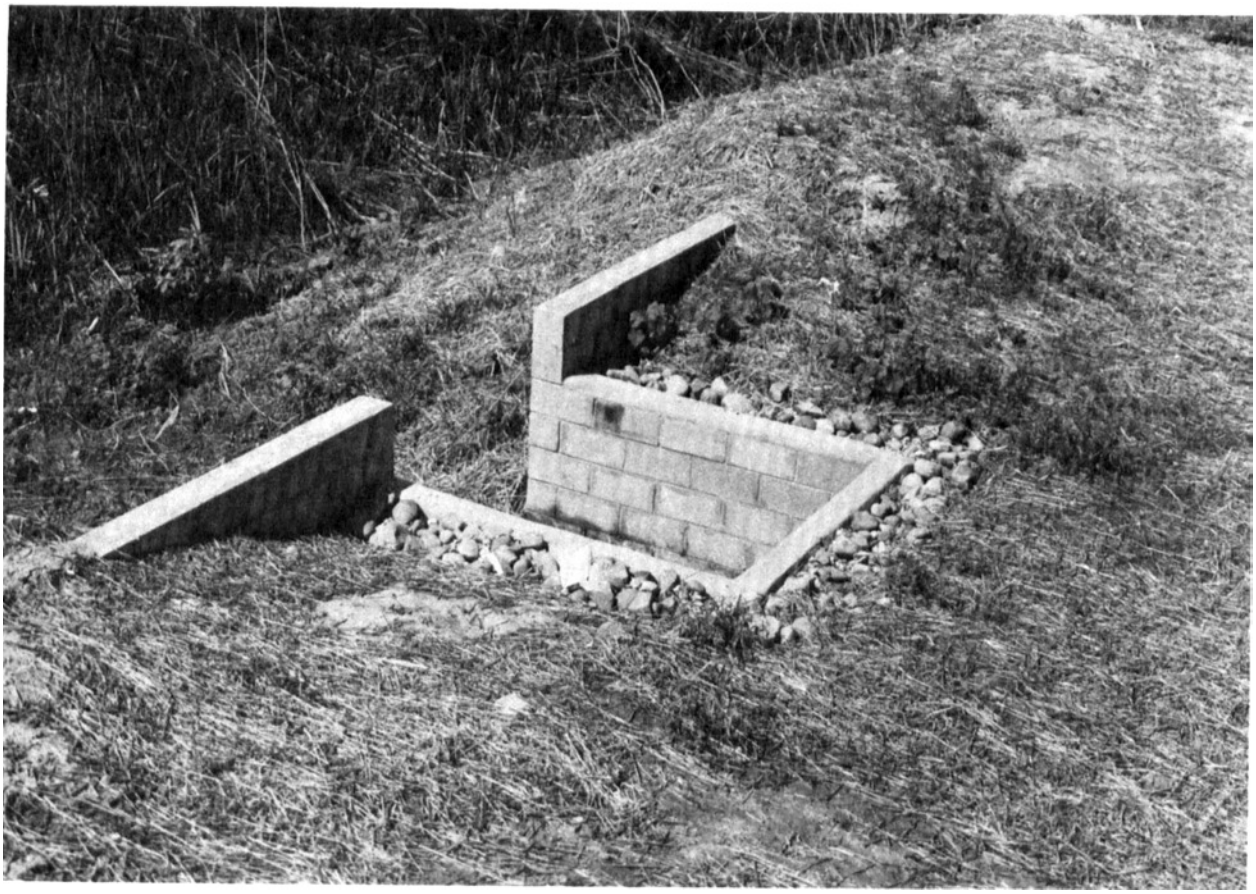


Figure 6.—A drainage ditch in an area of Tappan-Londo loams, 0 to 2 percent slopes. The toe-wall structure helps to prevent gullying.

These soils are well suited to woodland. The major concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soils are relatively dry or frozen. Planting seedlings that can withstand wet conditions reduces the seedling mortality rate. A shallow rooting depth caused by the seasonal high water table increases the windthrow hazard. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce this hazard.

Because of the wetness and the ponding, these soils are poorly suited to building site development. Surface and subsurface drainage systems help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site. Proper design and careful construction help to keep water away from basements.

The Tappan soil is generally unsuited to septic tank absorption fields because of the slow permeability and the ponding. The Londo soil is poorly suited because of the wetness and the moderate or moderately slow permeability. Special construction methods, such as filling with suitable material, can raise the absorption field above the water table in the Londo soil. Enlarging and pressurizing the absorption field help to overcome the moderate or moderately slow permeability. Both soils are poorly suited to sewage lagoons because of the ponding and the wetness. Installing shallow surface drains and adding fill material to the berm arour [illegible] lagoon help to control ponding and runoff.

The land capability classification is IIw. The Michigan soil management groups are 2.5c-c and 2.5b.

10B—Pipestone fine sand, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on flats, low knolls, and low ridges. Individual areas are irregularly shaped or linear and range from 4 to 200 acres in size.

Typically, the surface layer is black, friable fine sand about 6 inches thick. The subsurface layer is grayish brown, very friable fine sand about 4 inches thick. The subsoil is about 35 inches thick. It is mottled and is very friable and friable. The upper part is very dark grayish brown fine sand and dark brown loamy sand, and the lower part is dark yellowish brown fine sand. The substratum to a depth of about 60 inches is yellowish brown, mottled, loose fine sand. In places thin layers of loamy sand are in the substratum.

Included with this soil in mapping are small areas of the moderately well drained Covert, poorly drained Granby, and somewhat poorly drained Wixom soils. Covert soils are on knolls and ridges. Granby soils are in depressions and drainageways. Wixom soils have a loamy subsoil. They are in positions on the landscape similar to those of the Pipestone soil. Included soils make up 3 to 25 percent of the unit.

Permeability is rapid in the Pipestone soil. Available water capacity is low. Surface runoff is slow or very slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet from late in fall to late in spring.

Most areas of this soil are used as woodland. Some are used as cropland.

This soil is poorly suited to cropland. Corn, cucumbers, beans, and red clover, however, can be grown. The major management concerns are wetness, soil blowing, and the organic matter content. Both surface and subsurface drainage systems are needed to reduce the wetness. The soil can be easily overdrained. Erosion-control structures may be needed where surface ditches and natural drainageways enter deep drainage ditches. The soil is often droughty in the summer. Irrigation may be needed. Conservation tillage, windbreaks, rye buffer strips, cover crops, and stripcropping help to control soil blowing. Returning crop residue to the soil and regularly adding other organic material increase the organic matter content and the available water capacity.

This soil is fairly well suited to pasture. The major management concerns are wetness during the spring and droughtiness during the summer. Proper stocking rates, rotation or strip grazing, and restricted use during very dry and wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. A shallow rooting depth caused by the seasonal high water table increases the windthrow hazard. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce this hazard.

Because of the wetness, this soil is poorly suited to building site development. A surface or subsurface drainage system helps to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site.

Because of the wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Special construction methods, such as filling or mounding with suitable material, are needed to raise the absorption field above the water table. The soil is generally unsuited to sewage lagoons because of wetness and seepage.

The land capability classification is IVw. The Michigan soil management group is 5B.

11B—Metamora sandy loam, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on flats and low knolls. Individual areas are broad and irregularly shaped and range from 4 to 60 acres in size.

Typically, the surface layer is very dark grayish brown, friable sandy loam about 10 inches thick. The subsurface layer is yellowish brown, mottled, friable sandy loam about 10 inches thick. The subsoil is dark yellowish brown, mottled, friable loam about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous, firm loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Wixom and poorly drained Belleville and Corunna soils. Wixom soils are more droughty than the Metamora soil. They are in landscape positions similar to those of the Metamora soil. Belleville and Corunna soils are in drainageways and low depressions. Included soils make up about 2 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of the Metamora soil and moderately slow in the lower part. Available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet from late in fall to spring.

Most areas of this soil are used as cropland. Some are used as pasture or woodland.

This soil is well suited to corn, winter wheat, beans, and red clover. The major management concerns are wetness and soil blowing. Both surface and subsurface drainage systems are needed to reduce the wetness. Applying a system of conservation tillage, growing cover crops, and returning crop residue to the soil help to maintain tilth and reduce the susceptibility to soil blowing.

This soil is well suited to pasture. The major management concern is the wetness. Restricted grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard, both of which are caused by the wetness. Equipment should be used only when the soil is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow.

Because of the wetness, this soil is poorly suited to building site development. Surface or subsurface drainage methods help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site.

Because of the wetness and the moderately slow permeability in the lower part of the profile, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as filling or mounding with suitable material, may be needed to raise the absorption field above the water table. Pressurizing the absorption field helps to overcome the moderately slow permeability. The soil is poorly suited to sewage lagoons because of the wetness. Sealing the lagoon helps to prevent excessive seepage. Adding fill material to the berm around the lagoon helps to divert runoff water.

The land capability classification is IIw. The Michigan soil management group is 3/2b.

12—Corunna sandy loam. This nearly level, poorly drained soil is on flats and in depressions and drainageways. It is subject to ponding. Individual areas are irregular in shape and range from 4 to 280 acres in size.

Typically, the surface layer is very dark grayish brown, very friable sandy loam about 10 inches thick. The subsoil is mottled sandy loam about 23 inches thick. The upper part is dark grayish brown and very friable, and the lower part is grayish brown and friable. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown, mottled, friable and firm, calcareous loam. In some areas the surface layer is less than 10 inches thick. In other areas the soil has a calcareous surface layer and subsurface layer. In places less than 26 or more than 40 inches of moderately coarse textured material overlies the medium textured material.

Included with this soil in mapping are small areas of the poorly drained Belleville and somewhat poorly drained Metamora soils. Belleville soils are more droughty than the Corunna soil. They are in landscape positions similar to those of the Corunna soil. Metamora soils are on low knolls. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate or moderately rapid in the upper part of the Corunna soil and moderately slow in the lower part. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from late in fall to spring.

Most areas of this soil are farmed. Some are used as woodland.

This soil is well suited to corn, winter wheat, beans, and sugar beets. The major management concerns are wetness and compaction. Both surface and subsurface drainage systems are needed to reduce the wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed where natural drainageways enter the deeper drainage ditches. Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits root development. As the soil structure is altered by compaction and excessive tillage, surface crusting becomes more severe. Applying a system of conservation tillage, growing cover crops, and returning crop residue to the soil help to maintain tilth.

This soil is fairly well suited to pasture. The major management concerns are wetness and compaction. Restricted grazing during wet periods helps to prevent compaction and damage to the cover of forage plants. Proper stocking rates and rotation grazing help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. Because losses of planted seedlings are more than 50 percent and controlling windthrow is difficult, such harvest methods as selective cutting and strip

Because of the wetness, this soil is poorly suited to building site development. Buildings can be constructed on well compacted fill material, which raises the site. Surface and subsurface drainage methods help to lower the water table.

Because of the wetness and the moderately slow permeability, this soil is generally unsuited to septic tank absorption fields. It is poorly suited to sewage lagoons because of wetness and seepage. Sealing the lagoon helps to prevent excessive seepage. Adding fill material to the berm around the lagoon helps to divert runoff water.

The land capability classification is IIw. The Michigan soil management group is 3/2c.

13A—Wixom-Belleville loamy fine sands, 0 to 3 percent slopes. This map unit consists of a nearly level, somewhat poorly drained Wixom soil and a nearly level, poorly drained Belleville soil. The Wixom soil is on low mounds and low ridges. The Belleville soil is in depressions and drainageways and is subject to ponding. Individual areas are irregular in shape and range from 10 to 420 acres in size. They are about 45 to 65 percent Wixom and similar soils and 25 to 45 percent Belleville and similar soils. The soils occur as areas so small or so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Wixom soil is dark grayish brown, very friable loamy fine sand about 9 inches thick. The subsoil is about 28 inches thick. It is mottled. The upper part is dark brown fine sand and dark yellowish brown loamy fine sand, and the lower part is brown fine sandy loam. The substratum to a depth of about 60 inches is brown, mottled loam.

Typically, the surface layer of the Belleville soil is black, very friable loamy fine sand about 10 inches thick. The subsoil is mottled, very friable loamy fine sand about 12 inches thick. The upper part is grayish brown, and the lower part is brown. The substratum to a depth of about 60 inches is brown, mottled, firm loam. In some areas less than 20 or more than 40 inches of sandy material overlies the loamy material.

Included with these soils in mapping are small areas of the somewhat poorly drained Metamora soils and poorly drained Corunna soils. Corunna soils are in landscape positions similar to those of the Belleville soil. Metamora soils are in landscape positions similar to those of the Wixom soil. Both of the included soils are not so droughty as the Wixom and Belleville soils. They make up 5 to 15 percent of the unit.

Permeability is rapid in the upper part of the Wixom and Belleville soils and moderately slow in the lower part. Available water capacity is moderate. Surface runoff is slow on the Wixom soil and very slow or ponded on the Belleville soil. From late in fall to spring, the seasonal high water table is at a depth of 0.5 foot to 1.5 feet in the Wixom soil and is near or above the surface of the Belleville soil.

Most areas are farmed or wooded. These soils are fairly well suited to corn, beans, and red clover. The major management concerns are wetness, soil blowing, and the content of organic matter. Both surface and subsurface drainage systems are needed to reduce the wetness. Erosion-control structures may be needed where surface ditches and natural drainageways enter deeper drainage ditches. The soils are often droughty in the summer. Irrigation may be needed. Windbreaks, buffer strips, cover crops, stripcropping, and no-till planting help to control soil blowing. Returning crop residue to the soil and regularly adding other organic material increase the organic matter content.

These soils are only fairly well suited to pasture. The wetness is the main limitation, but seasonal droughtiness also is a limitation. Overgrazing or grazing when the soil is too wet destroys the cover of forage plants. Overgrazing during very dry periods can destroy the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during wet or very dry periods help to keep the pasture in good condition.

These soils are fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Planting or logging equipment should be used only when the soils are relatively dry or frozen. A shallow rooting depth caused by the seasonal high water table increases the windthrow hazard. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce this hazard.

Because of the wetness and the ponding, these soils are poorly suited to building site development. Buildings can be constructed on well compacted fill material, which raises the site. Surface or subsurface drainage methods help to lower the water table.

The Wixom soil is poorly suited to septic tank absorption fields because of the wetness and the moderately slow permeability in the lower part of the profile. The Belleville soil is generally unsuited because of the ponding. Special construction methods, such as filling or mounding with suitable material, are needed to raise the absorption field above the water table in the Wixom soil. Pressurizing the absorption field helps to overcome the moderately slow permeability. Both soils are generally unsuited to sewage lagoons because of seepage, ponding, and wetness.

The land capability classification is IIIw. The Michigan soil management groups are 4/2b and 4/2c.

14A—Avoca loamy fine sand, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on flats, low knolls, and low ridges. Individual areas are irregularly shaped or linear and range from 3 to 70 acres in size.

Typically, the surface layer is dark brown, very friable loamy fine sand about 11 inches thick. The subsoil is dark brown, mottled, friable loamy fine sand about 9 inches thick. The substratum to a depth of about 60 inches is brown, mottled, friable, calcareous loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Londo and Metamora and poorly drained Corunna and Tappan soils. These soils are not so droughty as the Avoca soil. Londo and Metamora soils are in landscape positions similar to those of the Avoca soil. Corunna and Tappan soils are slightly lower on the landscape than the Avoca soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the upper part of the Avoca soil and moderately slow in the lower part. Available water capacity is moderate. Surface runoff is slow or very slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet from late in fall to spring.

Most areas are farmed or wooded. This soil is fairly well suited to corn, beans, winter wheat, and red clover. The major management concerns are wetness, soil blowing, and the content of organic matter. Both surface and subsurface drainage systems are needed to reduce the wetness. Erosion-control structures may be needed where surface ditches and natural drainageways enter deep drainage ditches. The soil is often droughty in the summer. Irrigation may be needed. Establishing windbreaks and buffer strips, growing cover crops, applying a system of conservation tillage, stripcropping, and returning crop residue to the soil help to control soil blowing. Returning crop residue to the soil and regularly adding other organic material increase the organic matter content.

This soil is well suited to pasture. The wetness is the main limitation, but seasonal droughtiness also is a limitation. Overgrazing or grazing when the soil is too wet destroys the cover of forage plants. Overgrazing during very dry periods can destroy the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during wet or very dry periods help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. A shallow rooting depth caused by the seasonal high water table increases the windthrow hazard. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce this hazard.

Because of the wetness, this soil is poorly suited to building site development. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface drainage method helps to lower the water table.

Because of the wetness and the moderately slow permeability in the lower part of the profile, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as filling or mounding with suitable material, are needed to raise the absorption field above the water table. Pressurizing the absorption field helps to overcome the moderately slow permeability. The soil is unsuited to sewage lagoons because of wetness and seepage.

The land capability classification is IIIw. The Michigan soil management group is 4/2b.

18—Essexville loamy fine sand. This nearly level, poorly drained soil is on broad flats and in narrow swales. It is subject to ponding. Individual areas are irregularly shaped or elongated and range from 4 to many hundred acres in size.

Typically, the surface layer is black, very friable, calcareous loamy fine sand about 12 inches thick. The subsoil is dark grayish brown, mottled, loose, calcareous fine sand about 4 inches thick. The upper part of the substratum is pale brown and grayish brown, mottled, loose, calcareous fine sand. The lower part to a depth of about 60 inches is brown and grayish brown, mottled, firm, calcareous loam. In places the sandy material is less than 18 or more than 40 inches deep over the loamy material.

Included with this soil in mapping are small areas of the poorly drained Tappan and somewhat poorly drained Avoca soils. Tappan soils are not so droughty as the Essexville soil. Included soils make up 3 to 10 percent of the unit.

Permeability is rapid in the upper part of the Essexville soil and moderately slow in the lower part. Available water capacity is moderate. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from late in fall to spring. The surface layer contains free lime, which can cause phosphorus, manganese, and zinc deficiencies.

Most areas of this soil are farmed. Some are used as woodland.

This soil is fairly well suited to potatoes, beans, corn, cucumbers, and onions (fig. 7). The major management concerns are wetness, fertility, and soil blowing. Both surface and subsurface drains are needed to remove ponded and subsurface water. Some areas near Saginaw Bay are protected from ponding by dikes. Lift pumps are used to reduce the wetness in these areas. Applying fertilizer in bands near the planted crops or as foliar spray improves fertility. Applying a system of conservation tillage, returning crop residue to the soil, stripcropping, and establishing buffer strips, vegetative barriers, and field windbreaks help to control soil blowing. The soil is often droughty during the summer. Irrigation may be needed.

This soil is well suited to pasture. The major management concern is the wetness. Overgrazing or grazing when the soil is wet destroys the cover of forage plants. Restricted grazing during wet periods and rotation or strip grazing help to keep the pasture in good condition.

This soil is poorly suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. Because losses of planted seedlings are 50 percent or more and controlling windthrow is difficult, such harvest methods as selective cutting and strip cutting are needed.

Because of the ponding, this soil is poorly suited to building site development. It is generally not used as a building site. It is generally unsuited to septic tank absorption fields because of the ponding and the moderately slow permeability in the lower part of the profile. It is unsuited to sewage lagoons because of ponding and seepage.

The land capability classification is IIIw. The Michigan soil management group is 4/2c-c.

19A—Wasepi sandy loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on broad flats and along narrow drainageways. Individual areas are long or irregularly shaped and range from 4 to 160 acres in size.

Typically, the surface layer is very dark gray, friable, calcareous sandy loam about 9 inches thick. The subsoil is calcareous, mottled, firm sandy loam about 15 inches thick. The upper part is yellowish brown, and the lower part is dark grayish brown. The upper part of the substratum is grayish brown, mottled, loose, calcareous loamy sand. The lower part to a depth of about 60 inches is yellowish brown, calcareous coarse sand and very gravelly sand. In some areas in Watertown Township, the soil has a loamy substratum below a depth of 40 inches.

Included with this soil in mapping are small areas of the well drained Boyer, moderately well drained Perrin, and very poorly drained Gilford soils. Boyer and Perrin

Figure 7.—Onions and field corn in an area of Essexville loamy fine sand.

soils are higher on the landscape than the Wasepi soil. Gilford soils are in depressions and drainageways. Included soils make up about 3 to 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the Wasepi soil and very rapid in the lower part. Available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet from late in fall to spring.

Most areas of this soil are used as cropland or pasture. Some are used as woodland.

This soil is fairly well suited to corn, beans, red clover, and a mixture of alfalfa and bromegrass. Droughtiness is a limitation during some periods, but the seasonal wetness also is a limitation. Soil blowing is a hazard. The soil is droughty in midsummer. Irrigation may be needed. A surface and subsurface drainage system is needed to remove excess water in the spring (fig. 8). Applying a system of conservation tillage, establishing windbreaks and buffer strips, growing cover crops, and returning crop residue to the soil conserve moisture and help to control soil blowing.

This soil is well suited to pasture. Droughtiness is the main limitation, but the wetness also is a limitation. Grazing when the soil is wet can destroy the cover of forage plants. During the summer, the soil often does not have a sufficient moisture supply. Overgrazing during these dry periods can damage the forage plants and reduce the extent of the ground cover. Proper stocking rates, rotation or strip grazing, and restricted use during wet and very dry periods help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. A shallow rooting depth caused by the seasonal high water table increases the windthrow hazard. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce this hazard.

Because of the wetness, this soil is poorly suited to building site development. Surface and subsurface drainage methods help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site.

Because of the wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as filling or mounding with suitable material, are needed to raise the absorption field above the water table. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. The soil is generally unsuited to sewage lagoons because of seepage and wetness.

The land capability classification is IIIs. The Michigan soil management group is 4b.

20B—Guelph-Londo loams, 0 to 6 percent slopes. This map unit consists of nearly level to undulating soils. The moderately well drained Guelph soil is on the higher convex parts of the undulating landscape. The somewhat poorly drained Londo soil is on the lower concave parts of the landscape. Individual areas are irregular in shape and range from 20 to 1,500 acres in size. They are about 55 to 75 percent Guelph and similar soils and 20 to 40 percent Londo and similar soils. The soils occur as areas so small or so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Guelph soil is dark grayish brown, friable loam about 8 inches thick. The subsoil is loam about 15 inches thick. The upper part is mixed dark brown and brown and is friable, and the lower part is dark brown and firm. The substratum to a depth of about 60 inches is yellowish brown, firm, calcareous loam.

Typically, the surface layer of the Londo soil is dark grayish brown, friable loam about 10 inches thick. The subsoil also is about 10 inches thick. The upper part is dark yellowish brown, friable loam mixed with coatings of grayish brown, very friable sandy loam. The lower part is dark yellowish brown, firm loam. The substratum to a depth of about 60 inches is dark yellowish brown and brown, mottled, friable, calcareous loam.

Included with these soils in mapping are small areas of the somewhat poorly drained Avoca and poorly drained Tappan soils, which make up about 5 to 10 percent of the unit. Avoca soils are more droughty than the Guelph and Londo soils. They are in landscape positions similar to those of the Londo soil. Tappan soils are in low sags and drainageways. A few spots of moderately eroded

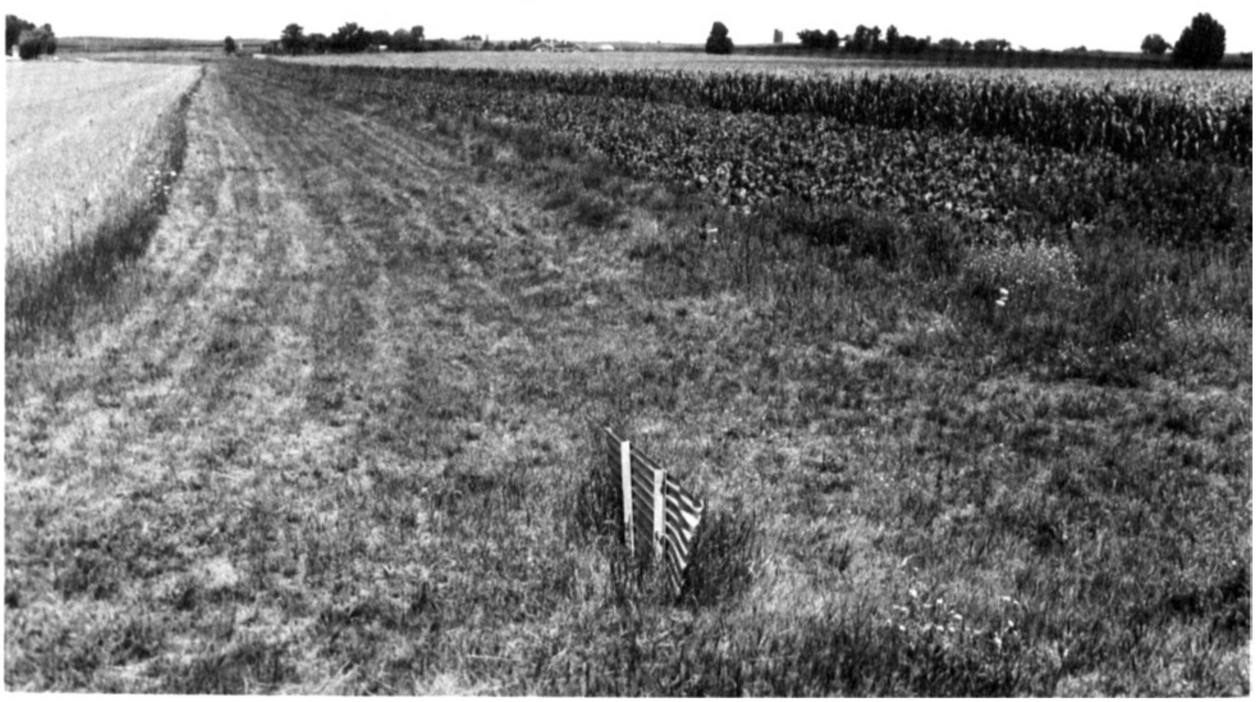


Figure 8.—A grassed waterway and drop inlet in an area of Wasepi sandy loam, 0 to 3 percent slopes.

soils are also included. These eroded soils have a surface layer that is thinner and lighter colored than that of the Guelph and Londo soils. They are on the upper parts of the landscape. They make up less than 2 percent of the unit.

Permeability is moderate in the Guelph soil. It is moderate or moderately slow in the Londo soil. Available water capacity is high in both soils. Surface runoff is medium or slow. The seasonal high water table in the Guelph soil is at a depth of 2.5 to 6.0 feet from early in winter to spring. The one in the Londo soil is at a depth of 1.0 to 2.0 feet from late in fall to spring.

Most areas of these soils are used as cropland. Some are used as pasture or woodland.

These soils are well suited to corn, winter wheat, beans, sugar beets, barley, and a mixture of alfalfa and bromegrass. Apples and sunflowers also can be grown. The major management concerns are water erosion, wetness, and compaction. Applying a system of conservation tillage, growing cover crops, establishing grassed waterways and diversions, and returning crop residue to the soil reduce the susceptibility to erosion, help to prevent compaction, and improve tilth. Random surface and subsurface drains reduce the wetness (fig. 9).

These soils are well suited to pasture. The major management concerns are compaction and wetness. Overgrazing or grazing during wet periods often results in compaction and damages the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard. Equipment should be used only when the soils are relatively dry or frozen. A shallow rooting depth caused by the seasonal high water table increases the hazard of windthrow in some areas. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce this hazard.

The Guelph soil is fairly well suited to building site development. The wetness of this soil is a limitation on sites for buildings with basements. The Londo soil is poorly suited to building site development because of the wetness. A drainage system helps to lower the water table. Well compacted fill material is needed to raise sites for buildings with or without basements in areas of

Figure 9.—Open drains in an area of Guelph-Londo loams, 0 to 6 percent slopes.

the Londo soil and to raise sites for buildings with basements in areas of the Guelph soil.

The Guelph soil is poorly suited to septic tank absorption fields because of the wetness, and the Londo soil is poorly suited because of the wetness and the restricted permeability. Special construction methods, such as filling or mounding with suitable material, are needed to raise the absorption field above the water table. Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability in the Londo soil.

These soils are poorly suited to sewage lagoons because of the wetness. Installing a surface drainage system and adding fill material to the berm around the lagoon reduce the wetness.

The land capability classification is IIe. The Michigan soil management groups are 2.5a and 2.5b.

20C—Guelph loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on knolls and ridges and in areas adjacent to drainageways. Individual areas are irregular in shape and range from 20 to 300 acres in size.

Typically, the surface layer is dark brown, friable loam about 8 inches thick. The subsoil is dark brown, firm loam about 12 inches thick. The substratum to a depth of about 60 inches is brown, firm, calcareous loam. In places the surface layer is eroded and has been mixed with the upper part of the subsoil by plowing.

Included with this soil in mapping are small areas of the somewhat poorly drained Londo and poorly drained Tappan soils in depressions and drainageways. These soils make up about 10 percent of the unit. A few spots of moderately eroded soils are also included. These eroded soils have a surface layer that is thinner and lighter colored than that of the Guelph soil. They are on the upper parts of side slopes. They make up less than 5 percent of the unit.

Permeability is moderate in the Guelph soil. Available water capacity is high. Surface runoff is medium or rapid.

Most areas of this soil are used as cropland. Some are used as pasture or woodland.

This soil is fairly well suited to corn, winter wheat, white beans, barley, and a mixture of alfalfa and bromegrass (fig. 10). The major management concerns are water erosion and compaction. Crop rotations that include small grain and hay, conservation tillage, grassed waterways, diversions, and cover crops help to prevent excessive erosion and compaction and improve tilth. The depressions and drainageways remain wet in spring. The wetness can delay fieldwork. It can be reduced by random surface and subsurface drains.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling erosion. The major management concern is compaction. Overgrazing can damage the forage plants, reduce the extent of the ground cover, and result in compaction and excessive runoff. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

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

Because of the slope, this soil is only fairly well suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Because of the slope, this soil is only fairly well suited to septic tank absorption fields. Special construction methods, such as land shaping, pressurizing the absorption field, and installing the distribution lines across the slope, help to overcome this limitation. The soil is poorly suited to sewage lagoons because of the slope. It generally is not used for this purpose.

The land capability classification is IIIe. The Michigan soil management group is 2.5a.

20D2—Guelph loam, 12 to 18 percent slopes, eroded. This rolling, well drained soil is on high knolls and side slopes adjacent to depressions and drainageways. Individual areas are irregular in shape and range from 10 to 95 acres in size.

Typically, the surface layer is brown, friable loam about 8 inches thick. The subsoil is dark brown, firm loam about 3 inches thick. The substratum to a depth of about 60 inches is brown, firm, calcareous loam. The original surface layer is eroded, and the upper part of the subsoil has been mixed with the surface layer by plowing. In many areas on the upper parts of the slopes, some of the substratum has been mixed with the surface layer by plowing. In these areas the surface layer is calcareous. The wooded areas are not eroded.

Included with this soil in mapping are small areas of the somewhat poorly drained Avoca and Londo and poorly drained Tappan soils. Avoca soils are droughtier than the Guelph soil. Avoca and Londo soils are on the lower side slopes. Tappan soils are in depressions. Included soils make up about 12 percent of the unit.

Permeability is moderate in the Guelph soil. Available water capacity is high. Surface runoff is rapid.

Most areas of this soil are used as cropland. Some are used as pasture or woodland.

This soil is poorly suited to cropland because of past erosion, the slope, and the rapid runoff. Such crops as corn, oats, winter wheat, and a mixture of alfalfa and bromegrass, however, can be grown. Crop rotations that include only grasses and legumes and small grain help to control runoff and erosion and prevent compaction.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling erosion. The major management concern is compaction. Overgrazing can damage forage plants, reduce the extent of the ground cover, and result in compaction, excessive runoff, and erosion. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

Figure 10.—White beans in an area of Guelph loam, 6 to 12 percent slopes.

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

Because of the slope, this soil is poorly suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Extensive land shaping is necessary in some areas. The less sloping areas away from waterways and depressions are the best building sites.

Because of the slope, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as land shaping, pressurizing the absorption field, and installing the distribution lines across the slope, help to overcome this limitation. The soil is generally unsuited to sewage lagoons because of the slope.

The land capability classification is IVe. The Michigan soil management group is 2.5a.

21B—Wixom loamy fine sand, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on low knolls and low ridges. Individual areas are irregular in shape and range from 4 to several hundred acres in size.

Typically, the surface layer is very dark brown, very friable loamy fine sand about 9 inches thick. The subsoil is about 23 inches thick. The upper part is dark brown loamy fine sand and dark yellowish brown, very friable fine sand; the next part is brown, mottled, very friable fine sand; and the lower part is dark yellowish brown sandy loam and grayish brown, mottled, friable silty clay loam. The substratum to a depth of about 60 inches is gray and yellowish brown, mottled, friable, calcareous silt loam. In some places the depth to the substratum is more than 40 inches. In other places the substratum is clay. In some areas it is stratified silt and fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Metamora and poorly drained Belleville and Corunna soils. Metamora soils are not so droughty as the Wixom soil. They are in positions on the landscape similar to those of the Wixom soil. Belleville and Corunna soils are in depressions and drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the upper part of the Wixom soil and moderately slow in the lower part. Available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet from late in fall to spring.

Most areas are used as cropland or woodland. This soil is fairly well suited to corn, beans, red clover, and winter wheat. The major management concerns are wetness, soil blowing, and the organic matter content. Both surface and subsurface drainage systems are needed to reduce the wetness. Erosion-control structures may be needed where surface ditches and natural drainageways enter deep drainage ditches. The soil is often droughty in the summer. Irrigation may be needed. Establishing windbreaks and buffer strips, growing cover crops, applying a system of conservation tillage, stripcropping, and returning crop residue to the soil help to control soil blowing. Returning crop residue to the soil and regularly adding other organic material increase the organic matter content.

This soil is well suited to pasture. The wetness is the main limitation, but seasonal droughtiness also is a limitation. Overgrazing or grazing when the soil is too wet destroys the cover of forage plants. Overgrazing during very dry periods can remove the plant cover and increases the susceptibility to soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during wet or very dry periods help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard, both of which are caused by the wetness. Equipment should be used only when the soil is relatively dry or frozen. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of the wetness, this soil is poorly suited to building site development. Surface and subsurface drainage methods help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site.

Because of the wetness and the moderately slow permeability in the lower part of the profile, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as filling or mounding with suitable material, are needed to raise the absorption field above the water table. Pressurizing the absorption field helps to overcome the restricted permeability. The soil is generally unsuited to sewage lagoons because of wetness and seepage.

The land capability classification is IIIw. The Michigan soil management group is 4/2b.

25A—Londo loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on flats, low knolls, and mounds. Individual areas are irregular in shape and 10 to several hundred acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 10 inches thick. The subsoil also is about 10 inches thick. The upper part is mixed dark yellowish brown, friable loam and grayish brown, very friable sandy loam, and the lower part is dark yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is dark yellowish brown and brown, mottled, friable, calcareous loam. In some places the depth to the substratum is more than 25 inches. In other places the subsoil does not have grayish brown coatings on the faces of peds. In some areas very firm material is in the part of the substratum below a depth of 40 inches.

Included with this soil in mapping are small areas of the moderately well drained Guelph, somewhat poorly drained Wixom, and poorly drained Tappan soils. Guelph soils are on knolls. Wixom soils are more droughty than the Londo soil. They are on slight knolls. Tappan soils are in depressions and drainageways. Included soils make up 5 to 20 percent of the unit.

Permeability is moderate or moderately slow in the Londo soil. Available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet from late in fall to spring.

Most areas of this soil are used as cropland. Some are used as pasture or woodland.

This soil is well suited to corn, sugar beets, beans, winter wheat, and a mixture of alfalfa and bromegrass. The major management concerns are wetness and compaction. Both surface and subsurface drainage systems are needed to reduce the wetness (fig. 11). Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits root development. As the soil structure is altered by compaction and excessive tillage, surface crusting becomes more severe. Applying a system of conservation tillage, growing cover crops, and returning crop residue to the soil help to maintain tilth.

This soil is well suited to pasture. The major management concerns are wetness and compaction. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard, both of which are caused by the wetness. Equipment should be used only when the soil is relatively dry or frozen. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of the wetness, this soil is poorly suited to building site development. Surface and subsurface drainage methods help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site.

Because of the wetness and the restricted permeability, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as

Figure 11.—An open drain in an area of Londo loam, 0 to 3 percent slopes.

absorption fields. Special construction methods, such as enlarging or pressurizing the absorption field, help to overcome the restricted permeability. Filling or mounding with suitable material helps to raise the absorption field above the water table. The soil is poorly suited to sewage lagoons because of the wetness. Installing surface drains and adding fill material to the berm around the lagoon help to control runoff water.

The land capability classification is IIw. The Michigan soil management group is 2.5b.

26B—Perrin loamy sand, 0 to 4 percent slopes. This nearly level and gently undulating, moderately well drained soil is on low ridges and knolls. Individual areas are linear or irregularly shaped and range from 4 to 160 acres in size.

Typically, the surface layer is dark grayish brown, very friable loamy sand about 11 inches thick. The subsurface layer is yellowish brown, very friable loamy sand about 9 inches thick. The subsoil is dark brown, mottled, friable fine sandy loam about 12 inches thick. The substratum to a depth of about 60 inches is pale brown and light yellowish brown, loose, calcareous sand and very gravelly sand. In places the upper part of the subsoil is redder.

Included with this soil in mapping are small areas of the well drained Boyer and somewhat poorly drained Wasepi soils. Boyer soils are in the slightly higher landscape positions. Wasepi soils are on the lower parts of the slopes and in slight depressions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Perrin soil and very rapid in the lower part. Available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth of 2.0 to 3.5 feet from late in fall to spring.

Most areas of this soil are used as cropland or pasture. Some are used as woodland.

This soil is fairly well suited to corn, beans, red clover, and a mixture of alfalfa and bromegrass. The major management concerns are droughtiness and soil blowing. Applying a system of conservation tillage, establishing windbreaks, returning crop residue to the soil, and growing winter cover crops improve the available water capacity and fertility and help to control soil blowing. Irrigation may be needed in dry summer months.

This soil is well suited to pasture. The major management concern is the droughtiness. During the summer, the soil does not have a sufficient moisture supply. Overgrazing during these dry periods can reduce the extent of the plant cover. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

This soil is well suited to woodland. The seedling mortality rate is the major management concern. It can be reduced by planting seedlings that can withstand droughty conditions, mulching, and shading the seedlings. Replanting may be needed in some areas.

This soil is fairly well suited to building site development. The wetness is a limitation on sites for buildings with basements. These buildings can be constructed on well compacted fill material, which raises the site. A drainage system helps to lower the water table.

Because of the wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as filling or mounding with suitable material, helps to raise the absorption field above the water table. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. The soil is generally unsuited to sewage lagoons because of seepage.

The land capability classification is IIIs. The Michigan soil management group is 4a.

27B—Boyer sandy loam, 0 to 6 percent slopes. This nearly level to undulating, well drained soil is on broad flats, ridges, and knolls. Individual areas are narrow or irregularly shaped and range from 4 to 160 acres in size.

Typically, the surface layer is very dark grayish brown, very friable sandy loam about 8 inches thick. The subsurface layer is dark yellowish brown, very friable loamy sand about 10 inches thick. The subsoil is dark yellowish brown, friable gravelly sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is brown, loose, calcareous gravelly sand. In some places the subsoil is thicker and contains more clay. In other places the depth to the substratum is more than 40 inches. In some areas the seasonal high water table is within a depth of 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Wasepi soils in slight depressions. These soils make up about 5 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of the Boyer soil and very rapid in the lower part. Available water capacity is low. Surface runoff is slow or medium.

Most areas of this soil are used as cropland. Some are used as woodland or pasture.

This soil is fairly well suited to corn, beans, winter wheat, and a mixture of alfalfa and bromegrass. The major management concerns are soil blowing, droughtiness, and the organic matter content. Conservation tillage, buffer strips, cover crops, and windbreaks help to control soil blowing, conserve moisture, and increase the organic matter content. The soil is often droughty in the summer. Irrigation may be needed.

This soil is well suited to pasture. The major management concern is the droughtiness. During the summer, the soil often does not have a sufficient moisture supply. Overgrazing during these dry periods can damage the forage plants and reduce the extent of the ground cover. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

This soil is well suited to woodland and building site development. No major hazards or limitations affect these uses.

Because of a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. The soil is generally unsuited to sewage lagoons because of seepage.

The land capability classification is IIIs. The Michigan soil management group is 4a.

27C—Boyer sandy loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on side slopes, ridges, and knolls. Individual areas are irregularly shaped or linear and range from 10 to 150 acres in size.

Typically, the surface layer is very dark grayish brown, very friable sandy loam about 8 inches thick. The subsurface layer is dark yellowish brown, very friable loamy sand about 10 inches thick. The subsoil is dark yellowish brown, friable gravelly sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is brown, loose, calcareous gravelly sand. In some places the subsoil is thicker and contains more clay. In other places the depth to the substratum is more than 40 inches. In some areas the slope is more than 12 percent. In other areas the surface layer is not so dark.

Included with this soil in mapping are some areas of the well drained Guelph and Marlette soils. These soils are less droughty than the Boyer soil. They are in positions on the landscape similar to those of the Boyer soil. They make up about 3 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of the Boyer soil and very rapid in the lower part. Available water capacity is low. Surface runoff is medium.

Most areas of this soil are used as cropland or woodland. Some are pastured.

This soil is fairly well suited to corn, beans, and a mixture of alfalfa and bromegrass. The major management concerns are water erosion, soil blowing, droughtiness, and the organic matter content. Fall plowing accelerates runoff and erosion. Conservation tillage, crop rotations that include small grain and hay, winter cover crops, rye buffer strips, and windbreaks help to prevent excessive soil loss, conserve moisture, and increase the organic matter content.

This soil is well suited to pasture. The major management concerns are erosion and droughtiness. During the summer, the soil does not have a sufficient moisture supply. Overgrazing during these dry periods can damage the forage plants and reduce the extent of the ground cover. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

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

Because of the slope, this soil is only fairly well suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Because of the slope and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. The soil is generally unsuited to sewage lagoons because of seepage and slope.

The land capability classification is IIIe. The Michigan soil management group is 4a.

28B—Marlette-Capac complex, 0 to 6 percent slopes. This map unit consists of nearly level to undulating soils. The well drained Marlette soil is on the higher convex parts of the undulating landscape. The somewhat poorly drained Capac soil is on the lower concave parts of the landscape. Individual areas are irregular in shape and range from 4 to several hundred acres in size. They are about 55 to 70 percent Marlette and similar soils and 25 to 40 percent Capac and similar soils. The soils occur as areas so small or so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Marlette soil is dark grayish brown, friable sandy loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part is yellowish brown, friable loam mixed with coatings of grayish brown sandy loam; the next part is dark brown, firm clay loam; and the lower part is brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, firm, calcareous loam. In places the slope is more than 6 percent.

Typically, the surface layer of the Capac soil is very dark grayish brown, friable loam about 10 inches thick. The subsoil is about 22 inches thick. The upper part is mixed dark yellowish brown and grayish brown, friable loam, and the lower part is dark yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm, calcareous loam.

Included with these soils in mapping are small areas of the well drained Boyer, Metea, and Spinks soils; the somewhat poorly drained Metamora soils; and the very poorly drained Wolcott soils. These included soils make up 3 to 20 percent of the unit. Boyer, Metea, and Spinks soils are more droughty than the Marlette and Capac soils. They are in landscape positions similar to those of the Marlette soil. Metamora soils contain less clay in the upper part than the Marlette and Capac soils. They are in landscape positions similar to those of the Capac soil. Wolcott soils are in depressions and drainageways. A few spots of moderately eroded soils are also included. These eroded soils have a surface layer that is thinner and lighter colored than that of the Marlette and Capac soils. They are on the upper parts of the undulating landscape. They make up less than 2 percent of the unit.

Permeability is moderately slow in the Marlette and Capac soils. Available water capacity is high. Surface runoff is slow or medium. The Capac soil has a seasonal high water table at a depth of 1 to 2 feet from late in fall to spring.

Most areas of these soils are used as cropland. Some are used as pasture or woodland.

These soils are well suited to corn, oats, winter wheat, beans, and grass-legume hay (fig. 12). The major management concerns are water erosion, soil blowing, wetness, and compaction. Applying a system of conservation tillage, growing cover crops, establishing grassed waterways, diversions, windbreaks, and buffer strips, and returning crop residue to the soil help to prevent excessive soil loss and compaction and improve tilth. Random surface and subsurface drains reduce the wetness.

These soils are well suited to pasture. The major management concerns are compaction and wetness. Either overgrazing or grazing areas of the Capac soil during wet periods often results in compaction and damages the forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard, both of which are caused by the wetness of the Capac soil. Equipment should be used only when the soils are relatively dry or frozen. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

The Marlette soil is well suited to building site development, but the Capac soil is poorly suited because of wetness. A surface and subsurface drainage system reduces the wetness. Also, the buildings can be constructed on well compacted fill material, which raises the site.

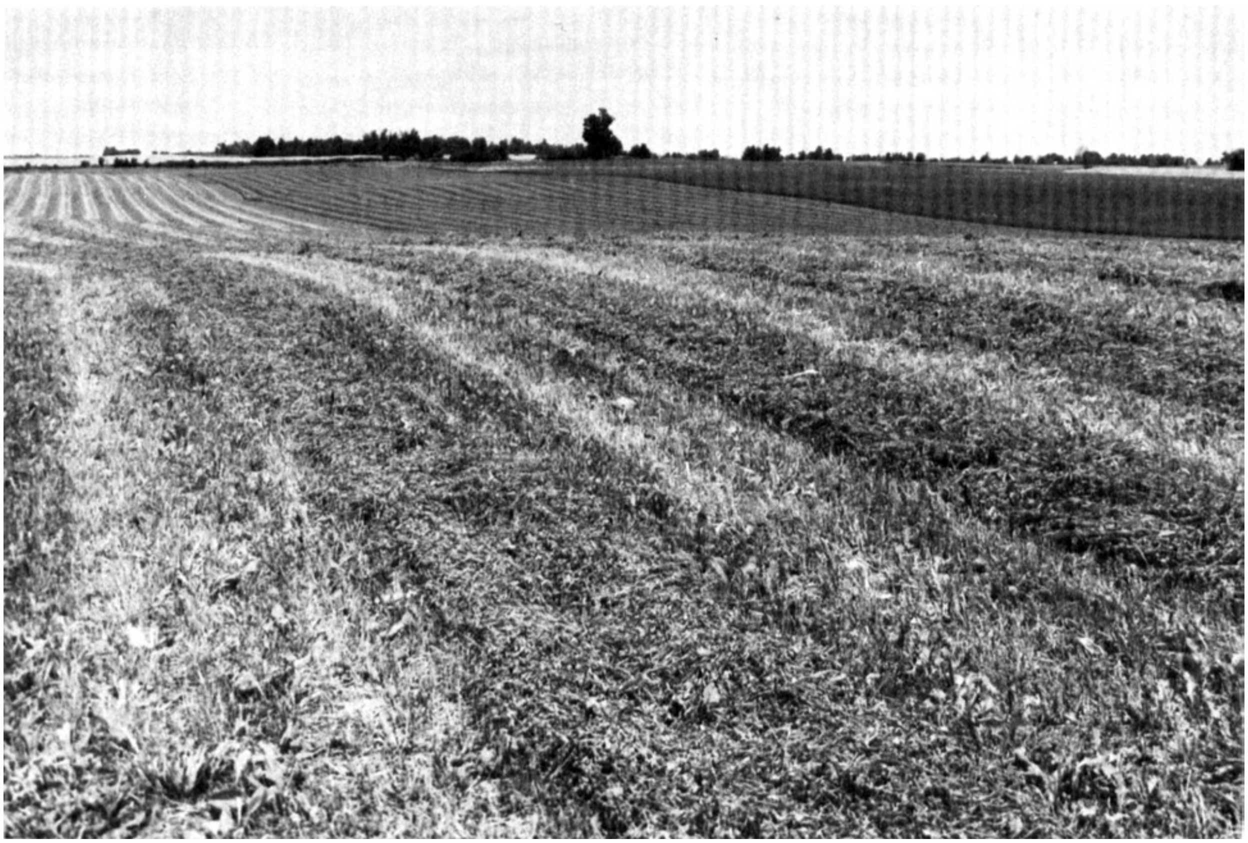


Figure 12.—Alfalfa hay in an area of the Marlette-Capac complex, 0 to 6 percent slopes.

The Marlette soil is poorly suited to septic tank absorption fields because of the moderately slow permeability, and the Capac soil is poorly suited because of the wetness and the moderately slow permeability. Special construction methods, such as filling or mounding with suitable material, are needed to raise the absorption field above the water table in the Capac soil. Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability in both soils.

The Marlette soil is only fairly well suited to sewage lagoons because of the slope, and the Capac soil is poorly suited because of the wetness. Some land shaping is needed to overcome the slope. Installing a surface drainage system and adding fill material to the berm around the lagoon help to overcome the wetness.

The land capability classification is IIe. The Michigan soil management groups are 2.5a and 2.5b.

28C—Marlette sandy loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on knolls and narrow side slopes. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is dark grayish brown, friable sandy loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part is yellowish brown, friable loam mixed with coatings of grayish brown sandy loam; the next part is dark brown, firm clay loam; and the lower part is brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, firm, calcareous loam. In some places it is gravelly sand below a depth of 40 inches. In other places the slope is more than 12 percent.

Included with this soil in mapping are small areas of the well drained Boyer, Metea, and Spinks soils; the somewhat poorly drained Capac soils; and the very poorly drained Wolcott soils. These soils make up 3 to 20 percent of the unit. Boyer, Spinks, and Metea soils are more droughty than the Marlette soil. They are in landscape positions similar to those of the Marlette soil. Capac soils are in concave areas between slopes. Wolcott soils are in depressions and drainageways. A few spots of moderately eroded soils are also included. These eroded soils have a surface layer that is thinner and lighter colored than that of the Marlette soil. They are on the upper parts of knolls and ridges. They make up less than 5 percent of the unit.

Permeability is moderately slow in the Marlette soil. Available water capacity is high. Surface runoff is medium.

Most areas of this soil are used as cropland. Some are used as pasture or woodland.

This soil is fairly well suited to corn, winter wheat, oats, and a mixture of alfalfa and bromegrass. The major management concerns are water erosion, soil blowing, and compaction. Conservation tillage, cropping systems that include close-growing crops, grassed waterways, cover crops, and incorporation of crop residue into the soil help to prevent excessive soil loss and compaction and improve tilth.

This soil is well suited to pasture. The major management concern is compaction. Overgrazing can reduce the extent of the plant cover and result in compaction, excessive runoff, and erosion. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

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

Because of the slope, this soil is only fairly well suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Because of the moderately slow permeability and the slope, this soil is poorly suited to septic tank absorption fields. Land shaping or installing the distribution lines across the slope helps to ensure that the absorption field functions properly. Special construction methods, such as enlarging or pressurizing the absorption field or installing alternating drain fields, help to overcome the restricted permeability. The soil is generally unsuited to sewage lagoons because of the slope.

The land capability classification is IIIe. The Michigan soil management group is 2.5a.

28D—Marlette sandy loam, 12 to 18 percent slopes. This rolling, well drained soil is on ridges. Individual areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown, friable sandy loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part is yellowish brown, friable loam mixed with coatings of grayish brown sandy loam; the next part is dark brown, firm clay loam; and the lower part is brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, firm, calcareous loam. In some places it is gravelly sand below a depth of 40 inches. In other places the slope is more than 18 percent.

Included with this soil in mapping are some areas of the well drained Metea and Spinks soils and small areas of the somewhat poorly drained Capac soils. These soils make up 10 to 25 percent of the unit. Metea and Spinks soils are more droughty than the Marlette soil. They are in landscape positions similar to those of the Marlette soil. Capac soils are in drainageways and concave areas. A few spots of moderately eroded soils are also included. These eroded soils have a surface layer that is thinner, lighter colored, and finer textured than that of the Marlette soil. They are on the upper parts of the ridges. They make up less than 10 percent of the unit.

Permeability is moderately slow in the Marlette soil. Available water capacity is high. Surface runoff is medium or rapid.

Most areas of this soil are used as woodland or pasture. Some are used as cropland.

This soil is poorly suited to cropland. Such crops as winter wheat, oats, red clover, and a mixture of alfalfa and bromegrass, however, can be grown. The major management concerns are water erosion, soil blowing, and compaction. Growing small grain and hay crops is effective in controlling erosion. Conservation tillage, grassed waterways, diversions, windbreaks, buffer strips, cover crops, and incorporation of crop residue into the soil help to control erosion and soil blowing and improve tilth.

This soil is fairly well suited to pasture. The major management concern is compaction. Overgrazing can damage the forage plants, reduce the extent of the ground cover, and result in compaction, excessive runoff, and erosion. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

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

Because of the slope, this soil is poorly suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Extensive land shaping is necessary in some areas, especially the ones that have a slope of more than 15 percent. The less sloping areas and the areas of sandy included soils away from waterways and depressions are the best building sites.

Because of the slope and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability. The soil is generally unsuited to sewage lagoons because of the slope.

The land capability classification is IVe. The Michigan soil management group is 2.5a.

28E—Marlette sandy loam, 18 to 35 percent slopes. This hilly and steep, well drained soil is on side slopes and ridges. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable sandy loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part is yellowish brown, friable loam mixed with coatings of grayish brown sandy loam; the next part is dark brown, firm clay loam; and the lower part is brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, firm, calcareous loam. In some places it is gravelly sand below a depth of 40 inches. In other places the slope is more than 35 percent.

Included with this soil in mapping are small areas of Boyer, Spinks, and Metea soils. These soils make up 10 to 25 percent of the unit. They are more droughty than the Marlette soil. They are in landscape positions similar to those of the Marlette soil. A few spots of moderately eroded soils are also included. These eroded soils have a surface layer that is thinner, lighter colored, and finer textured than that of the Marlette soil. They are on the upper parts of the side slopes and ridges. They make up less than 5 percent of the unit.

Permeability is moderately slow in the Marlette soil. Available water capacity is high. Surface runoff is rapid.

Most areas are used as woodland or pasture. Because of the erosion hazard and the slope, this soil is generally unsuited to cropland. It is fairly well suited to pasture. The major management concerns are erosion and compaction. Overgrazing can damage the forage plants, reduce the extent of the ground cover, and result in compaction, excessive runoff, and erosion. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation and the erosion hazard, both of which are caused by the slope. Heavy equipment should be used only on the top of the ridges and at the base of slopes. Building logging roads and skid trails on gentle grades helps to control erosion. It also helps to overcome the equipment limitation.

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

The land capability classification is VIe. The Michigan soil management group is 2.5a.

29B—Metea loamy fine sand, 1 to 6 percent slopes. This nearly level to undulating, well drained soil is on knolls and ridges. Individual areas are irregular in shape and range from 3 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, very friable loamy fine sand about 12 inches thick. The subsurface layer is dark yellowish brown, very friable loamy fine sand about 20 inches thick. The subsoil is about 11 inches thick. It is friable. The upper part is yellowish brown fine sandy loam, and the lower part is dark yellowish brown sandy clay loam. The substratum to a depth of about 60 inches is brown, firm, calcareous loam. In some places the sandy material is more than 39 inches thick. In other places the slope is more than 6 percent. In some areas the soil is moderately well drained.

Included with this soil in mapping are small areas of the well drained Guelph, Marlette, and Spinks soils and the somewhat poorly drained Londo and Wixom soils. Guelph, Londo, and Marlette soils are less droughty than the Metea soil, and Spinks soils are more droughty. Guelph, Marlette, and Spinks soils are in landscape positions similar to the Metea soil. Londo and Wixom soils are in the lower positions. Included soils make up 3 to 20 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. Available water capacity is moderate. Surface runoff is slow.

Most areas of this soil are used as cropland. A few are used as pasture or woodland.

This soil is fairly well suited to corn, beans, winter wheat, and a mixture of alfalfa and bromegrass. The major management concerns are soil blowing, droughtiness, and the organic matter content. Conservation tillage, windbreaks, rye buffer strips, cover crops, stripcropping, and cropping systems that include close-growing crops help to control soil blowing. The soil is often droughty in the summer. Irrigation may be needed. Returning crop residue to the soil and regularly adding other organic material increase the organic matter content.

This soil is well suited to pasture. The major management concern is droughtiness. Overgrazing can remove the plant cover and increase the susceptibility to soil blowing. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

This soil is well suited to woodland. The major concerns are the equipment limitation and seedling mortality. Planting seedlings that can withstand droughty conditions, mulching, and shading the seedlings lower the seedling mortality rate. Replanting is needed in some areas. Equipment should be used only when the soil is relatively dry or frozen.

This soil is well suited to building site development. It is only fairly well suited to septic tank absorption fields because of the moderately slow permeability in the lower part of the profile. Special construction methods, such as enlarging or pressurizing the absorption field or installing alternating drain fields, help to overcome the restricted permeability. The soil is generally unsuited to sewage lagoons because of seepage.

The land capability classification is IIIe. The Michigan soil management group is 4/2a.

30B—Spinks loamy fine sand, 0 to 6 percent slopes. This nearly level to undulating, well drained soil is on side slopes, knolls, and ridges. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is brown, loose fine sand about 14 inches thick.

Below this to a depth of about 60 inches is grayish brown and brown, loose fine sand that has many thin layers of dark yellowish brown, very friable loamy fine sand. In some places the part of the profile below the subsurface layer is gravelly sand. In other places the thin layers of loamy fine sand total less than 6 inches thick.

Included with this soil in mapping are small areas of the well drained Boyer and Metea and somewhat poorly drained Thetford soils. Boyer and Metea soils are in positions on the landscape similar to those of the Spinks soil. Boyer soils have a substratum of sand and gravel. Metea soils are less droughty than the Spinks soil. Thetford soils are in depressions and drainageways. Included soils make up 3 to 15 percent of the unit.

Permeability is moderately rapid in the Spinks soil. Available water capacity is low. Surface runoff is very slow or slow.

Most areas of this soil are used as cropland or pasture. Some are used as woodland.

This soil is fairly well suited to corn, beans, and a mixture of alfalfa and bromegrass. The major management concerns are droughtiness, soil blowing, and the organic matter content. The soil is often droughty in the summer. Irrigation may be needed. Applying a system of conservation tillage, establishing windbreaks and rye buffer strips, growing cover crops, stripcropping, and leaving crop residue on the surface help to control soil blowing. Including green manure crops in the cropping sequence and returning crop residue to the soil increase the organic matter content.

This soil is well suited to pasture. The major management concern is the droughtiness. Overgrazing can remove the plant cover and increases the susceptibility to soil blowing. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concern is seedling mortality. Planting seedlings that can withstand droughty conditions, mulching, and shading the seedlings lower the seedling mortality rate. Replanting may be needed in some areas.

This soil is well suited to building site development and septic tank absorption fields, but it is generally unsuited to sewage lagoons because of seepage.

The land capability classification is IIIs. The Michigan soil management group is 4a.

30C—Spinks loamy fine sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on side slopes, knolls, and ridges. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is brown, loose fine sand about 14 inches thick. Below this to a depth of about 60 inches is grayish brown and brown, loose fine sand that has many thin layers of dark yellowish brown, very friable loamy fine sand. In some places the part of the profile below the subsurface layer is gravelly sand or loam. In other places the thin layers of loamy fine sand total less than 6 inches thick.

Included with this soil in mapping are small areas of the well drained Boyer, Marlette, and Metea and somewhat poorly drained Thetford soils. Boyer, Marlette, and Metea soils are in positions on the landscape similar to those of the Spinks soil. Boyer soils have a substratum of sand and gravel. Marlette soils contain more clay than the Spinks soil. Metea soils are less droughty than the Spinks soil. Thetford soils are in the lower positions on the landscape. Included soils make up 3 to 15 percent of the unit.

Permeability is moderately rapid in the Spinks soil. Available water capacity is low. Surface runoff is slow.

Most areas of this soil are used as woodland. Some are used as pasture or cropland.

This soil is fairly well suited to corn, winter wheat, red clover, timothy, and a mixture of alfalfa and bromegrass. The major management concerns are water erosion, soil blowing, and droughtiness. Crop rotations that include grasses or legumes, conservation tillage, grassed waterways, and cover crops are effective in controlling water erosion. Windbreaks and buffer strips help to control soil blowing. Returning crop residue to the soil and adding other organic material conserve moisture.

This soil is well suited to pasture. The major management concern is the droughtiness. The soil is often droughty in summer. As a result, the forage plants grow slowly. Deferred grazing during periods of slow growth help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concern is seedling mortality. Planting seedlings that can withstand droughty conditions, mulching, and shading the seedlings lower the seedling mortality rate. Replanting may be needed in some areas.

Because of the slope, this soil is only fairly well suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil is generally unsuited to sewage lagoons because of the slope and seepage.

The land capability classification is IIIe. The Michigan soil management group is 4a.

30D—Spinks loamy fine sand, 12 to 18 percent slopes. This rolling, well drained soil is on side slopes and knolls. Individual areas are irregular in shape and range from 4 to 40 acres in size.

Typically, the surface layer is dark brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is brown, loose fine sand about 14 inches thick. Below this to a depth of about 60 inches is grayish brown and brown, loose fine sand that has many thin layers of dark yellowish brown, very friable loamy fine sand. In some places the soil has a substratum of loam. In other places the thin layers of loamy fine sand total less than 6 inches thick. In some areas the part of the profile below the subsurface layer is gravelly sand.

Included with this soil in mapping are small areas of the well drained Marlette and Metea soils. These soils are less droughty than the Spinks soil. They are on hilltops and side slopes. They make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Spinks soil. Available water capacity is low. Surface runoff is slow or medium.

Most areas of this soil are used as woodland. Some are pastured.

This soil is poorly suited to cropland. Such crops as winter wheat, oats, and a mixture of alfalfa and bromegrass, however, can be grown. The major management concerns are water erosion, soil blowing, and droughtiness. Growing grasses and legumes in rotation with small grain and applying a system of conservation tillage help to control water erosion and soil blowing and conserve moisture.

This soil is fairly well suited to pasture. The major management concerns are droughtiness and erosion. The soil is often droughty in summer. As a result, forage plants grow slowly. Overgrazing damages the forage plants. Deferred grazing during periods of slow growth help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concern is seedling mortality. Planting seedlings that can withstand droughty conditions, mulching, and shading the seedlings reduce the seedling mortality rate. Replanting may be needed in some areas.

Because of the slope, this soil is poorly suited to building site development and is only fairly well suited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Extensive land shaping is necessary in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil is generally unsuited to sewage lagoons because of the slope and seepage.

The land capability classification is IVe. The Michigan soil management group is 4a.

30E—Spinks loamy fine sand, 18 to 35 percent slopes. This hilly and steep, well drained soil is on side slopes and hills. Individual areas are irregularly shaped or elongated and range from 4 to 80 acres in size.

Typically, the surface layer is dark brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is brown, loose fine sand about 14 inches thick. Below this to a depth of about 60 inches is grayish brown and brown, loose fine sand that has many thin layers of dark yellowish brown loamy fine sand. In some places the thin layers of loamy fine sand total less than 6 inches thick. In other places the part of the profile below the subsurface layer is gravelly sand. In some areas the slope is more than 35 percent.

Included with this soil in mapping are small areas of the well drained Marlette soils. These soils are less droughty than the Spinks soil. They are on side slopes or hilltops. They make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Spinks soil. Available water capacity is low. Surface runoff is medium.

Most areas of this soil are used as woodland. A few are pastured. Because of the slope, this soil is generally unsuited to cropland. It is fairly well suited to pasture. The major concerns in managing the pastured areas are water erosion and droughtiness. Overgrazing during dry summers removes the plant cover. Proper stocking rates, rotation or strip grazing, and deferred grazing during dry periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the erosion hazard, the equipment limitation, and seedling mortality. The use of heavy equipment should be restricted because of the slope. Establishing logging roads and skid trails on gentle grades along the ridgetops and at the base of the slopes helps to overcome the erosion hazard and the equipment limitation. Planting seedlings that can withstand droughty conditions, mulching, and shading the seedlings lower the seedling mortality rate. Replanting may be needed in some areas.

Because of the slope, this soil is generally unsuitable for building site development and septic tank absorption fields. It is generally unsuited to sewage lagoons because of the slope and seepage.

The land capability classification is VIe. The Michigan soil management group is 4a.

32B—Thetford loamy fine sand, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on broad flats and in depressions and drainageways. Individual areas are irregular in shape and range from 4 to 200 acres in size.

Typically, the surface layer is very dark grayish brown, very friable loamy fine sand about 12 inches thick. The subsurface layer is yellowish brown, mottled, very friable loamy fine sand and fine sand about 14 inches thick. The subsoil is about 17 inches thick. The upper part is dark yellowish brown, mottled, very friable loamy fine sand, and the lower part is yellowish brown, mottled, loose fine sand that has thin layers of dark yellowish brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous fine sand. In some places the bands in the subsoil are finer textured. In other places the upper part of the subsoil is redder.

Included with this soil in mapping are small areas of the poorly drained Granby soils in depressions and drainageways. These soils make up 3 to 10 percent of the unit.

Permeability is moderately rapid. Available water capacity is low. Surface runoff is very slow or slow. The seasonal high water table is at a depth of 1 to 2 feet during winter and spring.

Most areas of this soil are used as cropland or woodland. Some are pastured.

This soil is fairly well suited to corn, soybeans, cucumbers, and small grain. Wetness is a limitation in the spring, and droughtiness commonly is a limitation in the summer. Soil blowing is a hazard. Both surface and subsurface drainage systems are needed to reduce the wetness. Erosion-control structures may be needed where surface ditches and natural drainageways enter deeper ditches. Windbreaks, rye buffer strips, cover crops, conservation tillage, and stripcropping help to control soil blowing. Crop rotations that include small grain and hay, incorporation of crop residue into the soil, and regular additions of other organic material conserve moisture. Irrigation may be needed during droughty periods.

This soil is well suited to pasture. The major management concerns are wetness in the spring and droughtiness in summer. Overgrazing or grazing when the soil is too wet or too dry can destroy the cover of forage plants, leaving the surface bare. Proper stocking rates, rotation or strip grazing, and restricted use during wet or very dry periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard, both of which are caused by the wetness. Equipment should be used only when the soil is relatively dry or frozen. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of the wetness, this soil is poorly suited to building site development. Surface or subsurface drainage methods help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site.

Because of the wetness, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as filling or mounding with suitable material, help to raise the absorption field above the water table. The soil is generally unsuited to sewage lagoons because of the wetness and seepage.

The land capability classification is IIIw. The Michigan soil management group is 4b.

33—Granby loamy fine sand. This nearly level, poorly drained soil is on low, broad flats and in depressions and drainageways. It is subject to ponding. Individual areas are irregularly shaped or linear and range from 10 to 150 acres in size.

Typically, the surface layer is black, very friable loamy fine sand about 11 inches thick. The subsoil is dark grayish brown, mottled, very friable loamy fine sand about 29 inches thick. The substratum to a depth of about 60 inches is olive brown and dark grayish brown, mottled, loose fine sand. In some places the surface layer is less than 10 inches thick. In other places the subsoil is brown. In some areas loamy material is in the substratum. In other areas the surface layer is muck. In places the subsoil is finer textured.

Included with this soil in mapping are small areas of the somewhat poorly drained Avoca and Pipestone soils. These soils are on low knolls and low ridges. They make up 3 to 25 percent of the unit.

Permeability is rapid in the Granby soil. Available water capacity is low. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from late in fall to spring.

Most areas of this soil are used as woodland or grassland. Some drained areas are used as cropland.

This soil is generally unsuited to cropland. Drainage outlets are not readily available. In areas that are adequately drained, such crops as corn, beans, cucumbers, and red clover can be grown. The major management concerns are wetness and soil blowing. Both surface and subsurface drainage systems are needed to reduce the wetness. The soil is often droughty in the summer. Irrigation may be needed. Conservation tillage, incorporation of crop residue into the soil, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing.

Because of the wetness, this soil is poorly suited to pasture. Overgrazing or grazing when the soil is wet destroys the cover of forage plants. Restricted grazing during wet periods and rotation or strip grazing are needed.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. The mortality rate of planted seedlings is 50 percent or more, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of the ponding and the rapid permeability, this soil is generally unsuited to building site development and sanitary facilities.

The land capability classification is Vw. The Michigan soil management group is 5c.

35—Wolcott loam. This nearly level, very poorly drained soil is on flats and in depressions and drainageways. It is subject to ponding. Individual areas are irregular in shape and range from 5 to 160 acres in size.

Typically, the surface layer is very dark gray, friable loam about 11 inches thick. The subsoil is mottled, friable loam about 21 inches thick. The upper part is olive gray, and the lower part is dark grayish brown. The substratum to a depth of about 60 inches is brown, mottled, firm, calcareous loam. In some places the surface layer is sandy loam. In other places the substratum is sand and gravelly sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Capac and Wixom soils. These soils are higher on the landscape than the Wolcott soil. They make up 3 to 15 percent of the unit.

Permeability is moderate in the Wolcott soil. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface during winter and spring.

Most areas of this soil are used as cropland. A few are wooded.

This soil is well suited to corn, winter wheat, beans, and sugar beets. The major management concerns are wetness and compaction. Both surface and subsurface drainage systems are needed to reduce the wetness. Erosion-control structures may be needed where natural drainageways enter ditches. Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits root development. As the natural soil structure is altered by compaction and excessive tillage, surface crusting becomes more severe. Conservation tillage, cover crops, and incorporation of crop residue into the soil improve tilth.

This soil is well suited to pasture. The major management concerns are wetness and compaction. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. The mortality rate of planted seedlings is 50 percent or more, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of the ponding, this soil is poorly suited to building site development. Surface and subsurface drainage methods help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site. Proper design and careful construction help to keep water away from basements.

Because of the ponding, this soil is generally unsuited to septic tank absorption fields and is poorly suited to sewage lagoons. Sealing sewage lagoons helps to prevent excessive seepage. It also protects the lagoons from runoff water. Installing shallow surface drains and adding fill material to the berm around the lagoon help to control runoff.

The land capability classification is IIw. The Michigan soil management group is 2.5c.

36—Tappan loam. This nearly level, poorly drained soil is on broad flats and in depressions and drainageways. It is subject to ponding. Individual areas are irregularly shaped or linear and range from 10 to several thousand acres in size.

Typically, the surface layer is very dark gray, friable, calcareous loam about 11 inches thick. The subsoil is dark gray, mottled, friable, calcareous loam about 8 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and brown, mottled, firm, calcareous loam. In some places the surface layer and subsoil are not calcareous. In other places they are coarser textured.

Included with this soil in mapping are small areas of the poorly drained Essexville and somewhat poorly drained Avoca and Londo soils. Essexville and Avoca soils are more droughty than the Tappan soil. Essexville soils are in landscape positions similar to those of the Tappan soil. Avoca and Londo soils are on low knolls. Included soils make up about 3 to 10 percent of the unit.

Permeability is moderate or moderately slow in the upper part of the Tappan soil and slow in the lower part. Available water capacity is high. Surface runoff is slow to ponded. The seasonal high water table is near or above the surface from late in fall to spring. The surface layer contains free lime, which can restrict the availability of manganese for sugar beets, beans, oats, and barley and the availability of zinc and phosphorus for corn and beans.

Most areas of this soil are used as cropland. Some are pastured or wooded.

This soil is well suited to corn, sugar beets, winter wheat, beans, oats, and barley. The major management concerns are wetness, compaction, and nutrient deficiencies. Both surface and subsurface drainage systems are needed to reduce the wetness. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Erosion-control structures may be needed where natural drainageways enter ditches. Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits root development. As the natural soil structure is destroyed by compaction and loss of organic matter, surface crusting becomes more severe. It can prevent seedling emergence and increase the runoff rate and the susceptibility to erosion. Conservation tillage, cover crops, incorporation of crop residue into the soil, and regular additions of other organic material help to maintain tilth. Applying fertilizer in bands near the planted crops or as foliar spray helps to overcome nutrient deficiencies.

This soil is well suited to pasture. The major management concerns are wetness and compaction. Overgrazing or grazing when the soil is wet may cause compaction of the surface layer and destroy the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Operating planting and harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is relatively dry or frozen. The mortality rate of planted seedlings is 50 percent or more, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of the wetness, this soil is poorly suited to building site development. Surface and subsurface drainage methods help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site. Proper design and careful construction help to keep water away from basements.

Because of the ponding and the restricted permeability, this soil is generally unsuited to septic tank absorption fields. It is poorly suited to sewage lagoons because of the ponding. Measures that protect the lagoons from ponding and runoff are needed. Examples are installing shallow surface drains and adding fill material to the berm around the lagoon.

The land capability classification is IIw. The Michigan soil management group is 2.5c-c.

37—Adrian muck. This nearly level, very poorly drained soil is in bogs and depressions. It is subject to ponding. Individual areas are irregular in shape and range from 10 to 90 acres in size.

Typically, the surface layer and subsurface layer are black, friable muck, which is about 22 inches thick. The substratum to a depth of about 60 inches is yellowish brown and dark gray, mottled, very friable, calcareous loamy fine sand. In some areas the muck is less than 16 inches thick. In other areas the subsurface layer has thin layers of mucky peat.

Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy material. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from late in fall to spring.

Most areas of this soil support wetland grasses or are wooded. Drained areas are used as cropland.

This soil is generally unsuited to cropland. Drainage outlets are not readily available. If the soil is drained, corn and specialty crops, such as carrots, celery, and onions, can be grown. The major management concerns are ponding, subsidence, frost, and soil blowing. Surface and subsurface drainage systems can reduce the wetness, but in many areas drainage outlets are needed. Lift pumps commonly are needed. Vegetative barriers, cover crops, and field windbreaks help to control soil blowing. Subsidence can be controlled by regulating the water table.

This soil is fairly well suited to pasture. The major management concerns are the wetness and the ponding. Proper stocking rates and restricted grazing during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. The equipment limitation is caused by wetness and low strength. Equipment should be used only when the soil is frozen. Losses of planted seedlings are 50 percent or more, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of ponding and low strength, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because of ponding. It is generally unsuited to sewage lagoons because of seepage, ponding, and excess humus.

The land capability classification is Vw. The Michigan soil management group is M/4c.

38—Tobico loamy fine sand. This nearly level, very poorly drained soil is on broad flats and in depressions and drainageways. It is subject to ponding. Individual areas are irregularly shaped or linear and range from 7 to 300 acres in size.

Typically, the surface layer is very dark grayish brown, friable, calcareous loamy fine sand about 12 inches thick. The upper part of the substratum is grayish brown, loose, calcareous, gravelly sand. The lower upper part to a depth of about 60 inches is dark grayish brown, loose, calcareous sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Wasepi and Pipestone soils on low knolls. These soils make up 3 to 10 percent of the unit.

Permeability is very rapid in the Tobico soil. Available water capacity is low. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface during fall, winter, and spring. The surface layer contains free lime, which can restrict the availability of manganese, zinc, and phosphorus for some crops.

Most areas of this soil are used as cropland or woodland. Some are pastured.

This soil is fairly well suited to potatoes, corn, and beans. The major management concerns are wetness, soil blowing, and fertility. Both surface and subsurface drainage systems are needed to reduce the wetness. Conservation tillage, incorporation of crop residue into the soil, stripcropping, vegetative barriers, windbreaks, cover crops, and a crop rotation that includes small grain and hay help to control soil blowing. Applying fertilizer in bands near the planted crops or as foliar spray helps to prevent nutrient deficiencies. The soil is often droughty in the summer. Irrigation may be needed.

This soil is well suited to pasture. The major management concern is the wetness. Overgrazing or grazing when the soil is wet destroys the cover of forage plants. Restricted grazing during wet periods and rotation or strip grazing help to keep the pasture in good condition.

This soil is poorly suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Operating planting and harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is relatively dry or frozen. Losses of planted seedlings are 50 percent or more, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of the ponding, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields and sewage lagoons because of the ponding, a poor filtering capacity, and seepage.

The land capability classification is IIIw. The Michigan soil management group is 5c-c.

39B—Ottokee loamy fine sand, 0 to 6 percent slopes. This nearly level to undulating, moderately well drained soil is on knolls and ridges. Individual areas are linear or irregularly shaped and range from 4 to 100 acres in size.

Typically, the surface layer is very dark grayish brown and dark brown, very friable loamy fine sand about 16 inches thick. The upper part of the subsoil is yellowish brown, loose fine sand that has thin layers of dark yellowish brown loamy fine sand. The lower part to a depth of about 60 inches is yellowish brown, mottled, loose fine sand that has thin layers of dark brown loamy fine sand. In places the upper part of the subsoil is darker.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone and Thetford soils. These soils are lower on the landscape than the Ottokee soil. They make up 3 to 10 percent of the unit.

Permeability is rapid in the Ottokee soil. Available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth of 2.0 to 3.5 feet during the winter and spring.

Most areas of this soil are used as woodland. Some are used as cropland or pasture.

This soil is fairly well suited to corn, beans, cucumbers, and red clover. The major management concerns are droughtiness and soil blowing. Irrigation, conservation tillage, windbreaks, incorporation of crop residue into the soil, and winter cover crops conserve moisture and help to control soil blowing.

This soil is well suited to pasture. The major management concern is the droughtiness during the summer. Overgrazing during droughty periods can reduce the extent of the plant cover. Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concern is seedling mortality. Selection of seedlings that can withstand droughty conditions and special site preparation, such as furrowing before planting, reduce the seedling mortality rate. Replanting may be needed in some areas.

This soil is fairly well suited to building site development. The wetness is a limitation on sites for buildings with basements. These buildings can be constructed on well compacted fill material, which raises the site. A drainage system helps to lower the water table.

Because of the seasonal high water table and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Special construction methods, such as filling with suitable material, help to raise the absorption field above the water table. The soil is generally unsuited to sewage lagoons because of wetness and seepage.

The land capability classification is IIIs. The Michigan soil management group is 4a.

40B—Chelsea fine sand, 0 to 6 percent slopes. This nearly level to undulating, somewhat excessively drained soil is on ridges, knolls, and broad flats. Individual areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is very dark grayish brown, very friable fine sand about 5 inches thick. The subsoil to a depth of about 60 inches is strong brown and yellowish brown, loose fine sand. It has thin layers of dark yellowish brown loamy fine sand in the lower part. In some places the wind has removed the surface layer and the upper part of the subsoil. In other places the seasonal high water table is within a depth of 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford soils in depressions and drainageways. These soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Chelsea soil. Available water capacity is low. Surface runoff is slow.

Most areas of this soil are used as woodland. Some of the acreage is pasture or is grassland that supports shrubs. A few areas are used as cropland.

This soil is poorly suited to cropland. Corn, beans, strawberries, and a mixture of alfalfa and bromegrass, however, can be grown. The major management concerns are droughtiness and soil blowing. Irrigation may be needed. Conservation tillage, windbreaks, incorporation of crop residue into the soil, and winter cover crops conserve moisture and help to control soil blowing.

Because of the droughtiness, this soil is only fairly well suited to pasture. It is often droughty in summer and early in fall. The forage plants grow slowly during these periods. Overgrazing when the soil is droughty damages the forage plants. Deferred grazing during the periods of slow growth helps to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation and seedling mortality. The sandy surface layer can adversely affect the trafficability of equipment during dry periods. Planting seedlings that can withstand droughty conditions, shading the seedlings, planting in furrows, and mulching decrease the seedling mortality rate. Replanting may be needed in some areas.

This soil is well suited to building site development. Because of a poor filtering capacity, it is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of shallow ground water supplies. The soil is generally unsuited to sewage lagoons because of seepage.

The land capability classification is IVs. The Michigan soil management group is 5a.

40C—Chelsea fine sand, 6 to 12 percent slopes. This gently rolling, somewhat excessively drained soil is on ridges and knolls. Individual areas are irregularly shaped or elongated and range from 3 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown, very friable fine sand about 5 inches thick. The subsoil to a depth of about 60 inches is strong brown and yellowish brown, loose fine sand. It has thin layers of dark yellowish brown loamy fine sand in the lower part. In some places the wind has removed the surface layer and the upper part of the subsoil. In other places the thin layers of loamy fine sand in the lower part of the subsoil total more than 6 inches thick.

Included with this soil in mapping are small areas of the moderately well drained Ottokee and somewhat poorly drained Thetford soils. Ottokee soils are on low knolls and side slopes. Thetford soils are in depressions and drainageways. Included soils make up 3 to 10 percent of the unit.

Permeability is rapid in the Chelsea soil. Available water capacity is low. Surface runoff is slow.

Most of the acreage is grassland or woodland. Some areas are pastured. Because of droughtiness, this soil is generally unsuited to cropland and is only fairly well suited to pasture. It is often droughty in summer and early in fall. Forage growth is slow during these periods. Overgrazing when the soil is droughty damages the forage plants. Deferred grazing during the periods of slow growth helps to keep the pasture in good condition.

This soil is only fairly well suited to woodland. The major management concerns are the equipment limitation and seedling mortality. The sandy surface layer can adversely affect the trafficability of equipment during dry periods. Planting seedlings that can withstand droughty conditions, shading the seedlings, planting in furrows, and mulching decrease the seedling mortality rate. Replanting may be needed in some areas.

Because of the slope, this soil is only fairly well suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Because of the slope and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. The soil is generally unsuited to sewage lagoons because of the slope and seepage.

The land capability classification is VIs. The Michigan soil management group is 5a.

42—Gilford sandy loam. This nearly level, very poorly drained soil is on low flats and in depressions and drainageways. It is subject to ponding. Individual areas are irregularly shaped or elongated and range from 10 to 200 acres in size.

Typically, the surface layer is black, friable sandy loam about 11 inches thick. The subsoil is dark grayish brown, mottled, friable sandy loam about 18 inches thick. The substratum to a depth of about 60 inches is grayish brown and dark grayish brown, calcareous, loose, stratified fine sand and gravelly sand. In places the surface layer and subsoil are calcareous.

Included with this soil in mapping are small areas of the somewhat poorly drained Wasepi soils. These soils are higher on the landscape than the Gilford soil. They make up 3 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Gilford soil and very rapid in the lower part. Available water capacity is low. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface during winter and spring. The surface layer may contain free lime, which can cause deficiencies in phosphorus, manganese, and zinc.

Most areas of this soil are used as woodland or cropland. Some are pastured.

This soil is fairly well suited to corn, soybeans, winter wheat, and red clover. The major management concerns are wetness, soil blowing, and fertility. Both surface and subsurface drains are needed to reduce the wetness. Conservation tillage, incorporation of crop residue into the soil, vegetative barriers, and cover crops help to control soil blowing. Applying fertilizer in bands near the planted crops or as foliar spray improves fertility. The soil is often droughty in the summer. Irrigation may be needed.

This soil is well suited to pasture. The major management concerns are wetness and ponding. Overgrazing or grazing when the soil is wet destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Operating planting and harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is relatively dry or frozen. Losses of planted seedlings are 50 percent or more, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of the ponding, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because of the ponding and a poor filtering capacity. It is generally unsuited to sewage lagoons because of the ponding and seepage.

The land capability classification is IIIw. The Michigan soil management group is 4c.

45—Houghton muck. This nearly level, very poorly drained soil is in depressional areas. It is subject to ponding. Individual areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is black, very friable muck about 16 inches thick. Below this to a depth of about 60 inches is black muck. In some places the subsurface layer has organic material that is not so well decomposed and has more than 10 inches of mucky peat. In other places the muck is stratified with mineral soil. In some areas it is less than 51 inches deep over sand, marl, or loam.

Permeability is moderately slow to moderately rapid. Available water capacity is very high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface during autumn, winter, and spring.

Most areas of this soil are used as woodland. A few are used as cropland or pasture.

This soil is generally unsuited to cropland because of ponding and soil blowing. If drained, it can be used for corn, carrots, celery, onions, and sod crops. Surface and subsurface drains can reduce the wetness, but drainage outlets are not readily available. Lift pumps commonly are needed. Vegetative barriers, cover crops, and windbreaks help to control soil blowing.

Because of the ponding, this soil is poorly suited to pasture. Proper stocking rates and restricted grazing during wet periods are needed.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is frozen. Such harvest methods as selective cutting and strip cutting help to prevent excessive windthrow and seedling mortality.

Because of ponding and low strength, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because of ponding. It is generally unsuited to sewage lagoons because of seepage, ponding, and excess humus.

The land capability classification is Vw. The Michigan soil management group is Mc.

52A—Landes fine sandy loam, 0 to 3 percent slopes. This nearly level, moderately well drained soil is on flood plains adjacent to the Cass River and White Creek. It is occasionally flooded. Individual areas are irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer is dark brown, very friable fine sandy loam about 12 inches thick. The subsoil is about 26 inches thick. It is dark yellowish brown. The upper part is friable loam; the next part is mottled, friable loam; and the lower part is mottled, very friable fine sandy loam. The substratum to a depth of about 60 inches is light olive brown and dark yellowish brown, mottled, very friable fine sandy loam and loamy fine sand. In places the upper part of the subsoil is mottled.

Permeability is rapid. Available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 4 to 6 feet during the spring.

Most of the acreage of this soil is grassland or woodland. A few areas are used as cropland.

This soil is fairly well suited to corn, beans, and winter wheat. The major management concerns are occasional flooding early in spring and soil blowing. Fieldwork should be delayed until after the period of flooding. Diking can reduce the flooding hazard. Conservation tillage, crop rotations that include small grain and hay, winter cover crops, windbreaks, and buffer strips help to control soil blowing.

This soil is well suited to pasture. The major management concern is the occasional flooding. Proper stocking rates and restricted use during periods of flooding help to keep the pasture in good condition.

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

Because of the flooding, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because of the flooding and a poor filtering capacity. It is generally unsuited to sewage lagoons because of the flooding and seepage.

The land capability classification is IIIw. The Michigan soil management group is L-2a.

53—Sloan loam. This nearly level, very poorly drained soil is on flood plains. It is subject to flooding. Escarpments are common between the uplands and the flood plains. Individual areas are irregular in shape and range from 10 to 400 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 14 inches thick. The subsoil is dark grayish brown, mottled, friable loam about 16 inches thick. The substratum to a depth of about 60 inches is olive brown, mottled, friable fine sandy loam. In places the surface layer is coarser textured.

Included with this soil in mapping are small areas of the very poorly drained Houghton, Palms, and Wolcott soils and the poorly drained Tappan soils. Houghton and Palms soils formed in organic deposits on the lower parts of the landscape. Tappan and Wolcott soils are not subject to flooding and are in the slightly higher landscape positions. Included soils make up 3 to 10 percent of the unit.

Permeability is moderate or moderately slow in the Sloan soil. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or at the surface from late in fall to spring.

Most areas of this soil are used as cropland or pasture. Some are wooded.

This soil is fairly well suited to corn, beans, and sugar beets. The major management concerns are wetness, flooding, and compaction. The flooding occurs only occasionally during the growing season. Both surface and subsurface drainage systems are needed to reduce the wetness. Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits root development. Conservation tillage, cover crops, and incorporation of crop residue into the soil improve tilth.

This soil is well suited to pasture. The major management concerns are wetness, flooding, and compaction. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Operating harvesting equipment is difficult during the wet periods. The equipment should be used only when the soil is relatively dry or frozen. Planted seedlings seldom survive, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of the flooding, this soil is not suited to building site development. It is not suited to septic tank absorption fields because of the flooding, the wetness, and the restricted permeability. It is not suited to sewage lagoons because of the flooding and the wetness.

The land capability classification is IIIw. The Michigan soil management group is L-2c.

54B—Capac loam, 1 to 5 percent slopes. This nearly level to undulating, somewhat poorly drained soil is on broad plains, low knolls, and low, concave slopes on ridges. Individual areas are irregular in shape and range from 4 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 10 inches thick. The subsoil is about 22 inches thick. The upper part is mixed dark yellowish brown and grayish brown, friable loam, and the lower part is dark yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm, calcareous loam.

Included with this soil in mapping are areas of the well drained Marlette, somewhat poorly drained Wixom, and very poorly drained Wolcott soils. Marlette soils are in the higher landscape positions. Wixom soils are more droughty than the Capac soil. They are in landscape positions similar to those of the Capac soil. Wolcott soils are in the lower landscape positions. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Capac soil. Available water capacity is high. Surface runoff is slow or medium. The seasonal high water table is at a depth of 1 to 2 feet from late in fall to spring.

Most areas of this soil are used as cropland. A few are used as pasture or woodland.

This soil is well suited to corn, beans, winter wheat, and a mixture of grasses and legumes. The major management concerns are water erosion, wetness, and compaction. Conservation tillage, cover crops, and incorporation of crop residue into the soil help to control water erosion and improve tilth. Both surface and subsurface drainage systems are needed to reduce the wetness. Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits root development.

This soil is well suited to pasture. The major management concerns are wetness and compaction. Overgrazing or grazing when the soil is wet causes compaction and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of the wetness, this soil is poorly suited to building site development. Surface or subsurface drainage methods help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site.

Because of the wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as filling or mounding with suitable material, may be needed to raise the absorption field above the water table.

Enlarging or pressurizing the absorption field and installing alternating drain fields help to overcome the restricted permeability. The soil is poorly suited to sewage lagoons because of the wetness. Adding fill material to the berm around the lagoon helps to control runoff.

The land capability classification is IIe. The Michigan soil management group is 2.5b.

55—Cohoctah sandy loam. This nearly level, very poorly drained soil is on flood plains. It is frequently flooded. Escarpments are common between the uplands and the flood plains. Individual areas are long and narrow or irregularly shaped and range from 5 to 55 acres in size.

Typically, the surface layer is very dark grayish brown, friable sandy loam about 23 inches thick. The upper part of the substratum is dark gray, mottled, friable loamy sand. The next part is dark grayish brown, mottled, friable sandy loam and gravelly sandy loam. The lower part to a depth of about 60 inches is dark yellowish brown, mottled, loose gravelly loamy sand. In places the upper part of the profile is dominantly loamy sand or loam.

Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Available water capacity is moderate. Surface runoff is very slow or ponded. The seasonal high water table is at or near the surface from fall to spring.

Most areas of this soil are used as woodland or support wetland vegetation. A few are pastured.

This soil is generally unsuited to cropland. If the soil is drained and protected from flooding, however, corn, beans, and sugar beets can be grown. The major management concerns are the wetness and the flooding during the growing season. In places the soil is not accessible to farm equipment because of the escarpments.

This soil is poorly suited to pasture. The major management concerns are the wetness and the frequent flooding. Proper stocking rates, rotation grazing, and restricted use during wet periods are needed.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Operating planting and harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is relatively dry or frozen. Planted seedlings seldom survive, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of the flooding and the wetness, this soil is not suited to building site development. It is not suited to septic tank absorption fields because of the flooding, the wetness, and a poor filtering capacity. It is not suited to sewage lagoons because of the flooding, the wetness, and seepage.

The land capability classification is Vw. The Michigan soil management group is L-2c.

56—Edwards muck. This nearly level, very poorly drained soil is in bogs and depressions. It is subject to ponding. Individual areas are irregular in shape and range from 4 to 100 acres in size.

Typically, the surface layer and subsurface layer are black, friable muck, which is about 26 inches thick. The substratum to a depth of about 60 inches is light gray and light brownish gray marl. In some places the marl is 5 to 20 inches thick and is underlain by sand or loam. In other places the muck is less than 16 inches thick.

Permeability is moderately slow to moderately rapid in the organic material. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from fall to spring.

Most areas of this soil support wetland vegetation or are wooded. A few are pastured.

This soil is generally not used as cropland because of long periods of wetness and ponding. Draining the soil is not generally practical. A few hundred acres in the central part of Fremont Township, however, have been cleared and drained and are used for potatoes. The major management concerns are wetness, ponding, soil blowing, and fertility. Open ditches can reduce the wetness, but they require frequent repair because the ditchbanks are unstable. Vegetative barriers and windbreaks help to control soil blowing. Applications of fertilizer, including minor nutrients, may be needed to improve fertility.

Because of the wetness, this soil is only fairly well suited to pasture. Proper stocking rates and restricted grazing during wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is frozen. Because of seedling mortality and windthrow, such harvest methods as selective cutting and strip cutting are needed.

Because of ponding and low strength, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because of ponding. It is generally unsuited to sewage lagoons because of seepage, ponding, and excess humus.

The land capability classification is Vw. The Michigan soil management group is M/mc.

57—Palms muck. This nearly level, very poorly drained soil is in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer and subsurface layer are black and very dark brown, friable muck, which is about

25 inches thick. The upper part of the substratum is dark grayish brown, mottled, friable loamy sand and grayish brown, mottled, firm silt loam. The lower part to a depth of about 60 inches is dark gray sand and gray, firm silt loam. In places the muck is less than 16 inches thick.

Permeability is moderately slow to moderately rapid in the mucky material and moderate or moderately slow in the substratum. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface during winter and spring.

Most areas of this soil are used as cropland or support wetland vegetation. A few are wooded.

This soil is generally unsuited to cropland because of the ponding. If drained, some areas can be used for corn or specialty crops, such as carrots, celery, onions, and sod. The major management concerns are wetness and soil blowing. Both surface and subsurface drainage systems are needed to reduce the wetness. Vegetative barriers, cover crops, and windbreaks help to control soil blowing.

Because of the wetness and the ponding, this soil is only fairly well suited to pasture. Proper stocking rates and restricted grazing during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is frozen. Planted seedlings seldom survive, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of ponding and low strength, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because of ponding. It is generally unsuited to sewage lagoons because of seepage, ponding, and excess humus.

The land capability classification is Vw. The Michigan soil management group is M/3c.

58—Thomas muck. This nearly level, very poorly drained soil is on broad flats and in depressions. It is frequently ponded. Individual areas are irregularly shaped or linear and range from 10 to 100 acres in size.

Typically, the surface layer is black, friable muck about 12 inches thick. Below this is dark gray, mottled, firm, calcareous loam about 10 inches thick. The upper part of the substratum is dark grayish brown, mottled, firm, calcareous silty clay loam. The next part is brown, mottled, friable, calcareous, stratified silt loam and loamy sand. The lower part to a depth of about 60 inches is brown, mottled, friable, calcareous loam.

Included with this soil in mapping are small areas of the poorly drained Tappan soils. These soils have a mineral surface layer and are calcareous. They make up 3 to 5 percent of the unit.

Permeability is moderately slow in the upper part of the Thomas soil and slow or moderately slow in the lower part. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface during winter and spring.

Most areas of this soil are used as cropland. Some are pastured or wooded.

This soil is well suited to corn, potatoes, beans, and sugar beets. The major management concerns are wetness and soil blowing. Both surface and subsurface drainage systems are needed to reduce the wetness. Lift pumps are needed in areas where adequate drainage outlets are not available. Shallow surface ditches are effective in removing surface water after heavy rains. Conservation tillage, buffer strips, and cover crops help to control soil blowing.

Because of the wetness and the ponding, this soil is only fairly well suited to pasture. Overgrazing or grazing when the soil is wet destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Operating planting and harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is frozen. Planted seedlings seldom survive, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of the ponding, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because of the ponding and the restricted permeability. It is generally unsuited to sewage lagoons because of excess humus and the ponding.

The land capability classification is IIw. The Michigan soil management group is 2.5c-c.

59—Pella silt loam. This nearly level, poorly drained soil is in low, concave areas and in drainageways. It is subject to ponding. Individual areas are irregular in shape and range from 10 to 95 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 12 inches thick. The subsoil is mottled, friable silt loam about 20 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable, calcareous silt loam. In places the surface layer and subsoil have less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Sanilac and Wixom soils. These soils are higher on the landscape than the Pella soil. They make up 3 to 15 percent of the unit.

Permeability is moderate in the Pella soil. Available water capacity is high. Surface runoff is slow to ponded. The seasonal high water table is near or above the surface during winter and spring.

Most areas of this soil are used as cropland. Some of the acreage is grassland or woodland.

This soil is well suited to corn, beans, sugar beets, and winter wheat. The major management concerns are wetness and compaction. Both surface and subsurface drainage systems are needed to reduce the wetness. Fine sand and silt can plug tile lines. As a result, tile drainage systems should be designed so that the rate of flowing water helps to keep the tile lines clean. Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits root development. Conservation tillage, cover crops, and incorporation of crop residue into the soil improve tilth.

Because of wetness and compaction, this soil is only fairly well suited to pasture. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. Planted seedlings seldom survive, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed.

Because of the ponding, this soil is generally unsuited to building site development and septic tank absorption fields and is poorly suited to sewage lagoons. Sealing sewage lagoons helps to prevent excessive seepage. Adding fill material to the berm around the lagoon helps to control ponding and runoff.

The land capability classification is IIw. The Michigan soil management group is 2c-s.

62A—Sanilac silt loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on broad flats and low knolls. Individual areas are irregular in shape and range from 5 to 420 acres in size.

Typically, the surface layer is very dark grayish brown, friable, calcareous silt loam about 13 inches thick. The subsoil is mottled, friable, calcareous silt loam about 22 inches thick. The upper part is brown and has grayish brown silt coatings, and the lower part is yellowish brown. The substratum to a depth of about 60 inches is brown, mottled, friable, calcareous silt loam.

Included with this soil in mapping are small areas of the poorly drained Bach and somewhat poorly drained Rapson soils. Bach soils are in depressions and drainageways. Rapson soils are more droughty than the Sanilac soil. They are in landscape positions similar to those of the Sanilac soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate or moderately slow in the Sanilac soil. Available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet during autumn, winter, and spring. The surface layer contains free lime, which can restrict the availability of manganese for sugar beets, beans, oats, and barley and the availability of zinc and phosphorus for corn and beans.

Most areas of this soil are used as cropland. A few are pastured or wooded.

This soil is well suited to corn, beans, winter wheat, and red clover. The major management concerns are wetness, compaction, soil blowing, and fertility. Both surface and subsurface drainage systems are needed to reduce the wetness. Fine sand and silt can plug tile lines. As a result, tile drainage systems should be designed so that the rate of flowing water helps to keep the tile lines clean. Also, suitable filtering material may be needed to keep the silt and fine sand from flowing into the tile lines. Shallow surface ditches are effective in removing surface water from low areas after heavy rains. Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits root development. As the natural soil structure is altered by compaction, surface crusting becomes more severe. It can prevent seedling emergence and increase the runoff rate and the susceptibility to erosion. Conservation tillage, cover crops, and incorporation of crop residue into the soil help to control soil blowing and maintain tilth. Applying fertilizer in bands near the planted crops or as foliar spray helps to overcome nutrient deficiencies.

This soil is well suited to pasture. The major management concerns are wetness and compaction. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard, both of which are caused by wetness. Equipment should be used only when the soil is relatively dry or frozen. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of the wetness, this soil is poorly suited to building site development. Surface or subsurface drainage methods help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the site.

Because of the wetness and the restricted permeability, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as filling or mounding with suitable material, help to raise the absorption field above the water table. Enlarging or pressurizing the absorption field and installing alternating drain fields help to overcome the restricted permeability.

The soil is generally unsuited to sewage lagoons because of the wetness and seepage.

The land capability classification is IIw. The Michigan soil management group is 2.5b-cs.

63—Bach very fine sandy loam. This nearly level, poorly drained soil is in low, concave areas and in depressions and drainageways. It is subject to ponding. Individual areas are irregularly shaped or linear and range from 10 to 150 acres in size.

Typically, the surface layer is very dark gray, friable, calcareous very fine sandy loam about 14 inches thick. The subsoil is dark grayish brown, mottled, firm, calcareous very fine sandy loam about 9 inches thick. The substratum to a depth of about 60 inches is gray and light brownish gray, mottled, calcareous, stratified very fine sandy loam. In some places the surface layer is less than 10 inches thick. In other places it is not calcareous.

Included with this soil in mapping are areas of the somewhat poorly drained Sanilac soils on knolls. These soils make up about 3 to 5 percent of the unit.

Permeability is moderate in the Bach soil. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface during autumn, winter, and spring. The surface layer contains free lime, which can restrict the availability of manganese, zinc, and phosphorus.

Most areas of this soil are farmed. Some are wooded.

This soil is well suited to corn, beans, sugar beets, and red clover. The major management concerns are wetness, compaction, soil blowing, and fertility. Both surface and subsurface drainage systems are needed to reduce the wetness. Fine sand and silt can plug tile lines. As a result, tile drainage systems should be designed so that the rate of flowing water helps to keep the tile lines clean. Also, suitable filtering material may be needed to keep the silt and fine sand from flowing into the tile lines. Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits root development. Conservation tillage, cover crops, and incorporation of crop residue into the soil help to maintain tilth and control soil blowing. Applying fertilizer in bands near the planted crops or as foliar spray helps to overcome nutrient deficiencies.

Because of wetness and compaction, this soil is only fairly well suited to pasture. Overgrazing or grazing when the soil is wet causes compaction of the surface layer and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Operating planting and harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is relatively dry or frozen. Because planted seedlings seldom survive and controlling windthrow is difficult, such harvest methods as selective cutting and strip cutting are needed.

Because of the ponding, this soil is generally unsuited to building site development, septic tank absorption fields, and sewage lagoons.

The land capability classification is IIw. The Michigan soil management group is 2.5c-cs.

64—Tappan-Lenawee Variant complex. The map unit consists of a nearly level, poorly drained Tappan soil and a nearly level, very poorly drained Lenawee Variant soil. The Tappan soil is slightly higher on the landscape than the Lenawee Variant soil. The Lenawee Variant soil is in low drainageways, in depressions, and on flats. Both soils are subject to ponding. Individual areas are broad and irregular in shape and range from 7 to 160 acres in size. They are about 45 to 55 percent Tappan soil and 40 to 50 percent Lenawee Variant soil. The two soils occur as areas so small or so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Tappan soil is very dark gray, friable, calcareous loam about 12 inches thick. The subsoil is dark gray, mottled, friable, calcareous loam about 5 inches thick. The substratum to a depth of about 60 inches is olive and dark grayish brown, mottled, firm, calcareous loam. In places the soil is more silty throughout.

Typically, the surface layer of the Lenawee Variant soil is very dark gray, calcareous silty clay loam about 10 inches thick. The substratum to a depth of about 60 inches is stratified and calcareous. In sequence downward, it is light gray, friable clay loam; grayish brown, mottled, friable silty clay loam; dark grayish brown, mottled, firm silty clay loam; and brown, mottled, firm loam.

Included with these soils in mapping are small areas of the very poorly drained Thomas soils. These included soils have an organic surface layer. They are in landscape positions similar to those of the Lenawee Variant soil. They make up 3 to 5 percent of the unit.

Permeability is moderate or moderately slow in the upper part of the Tappan soil and slow in the lower part. It is moderately slow or slow in the Lenawee Variant soil. Available water capacity is high in the Tappan soil and moderate in the Lenawee Variant soil. Surface runoff is slow to ponded on both soils. The seasonal high water table is near or above the surface from late in fall to spring. The surface layer contains free lime, which can restrict the availability of phosphorus, manganese, and zinc.

Most areas of these soils are used as cropland. A few are pastured.

These soils are fairly well suited to corn, beans, spring grain, and sugar beets. The major management concerns are wetness, fertility, and compaction. Also, the shallow limy layer can restrict the rooting depth and the available water capacity. Both surface and subsurface drainage systems are needed to reduce the wetness and control the ponding. Catchments and lift pumps are needed in areas where adequate outlets for subsurface drainage are not available. Applying phosphorus, magnesium, and zinc fertilizer in bands near the planted crops or as foliar spray helps to overcome nutrient deficiencies. Working these soils when they are wet results in cloddiness and compaction. Compaction inhibits root development. As the soil structure is altered by compaction, surface crusting becomes more severe. Conservation tillage, cover crops, green manure crops, and incorporation of crop residue into the soil improve tilth.

Because of wetness and compaction, these soils are only fairly well suited to pasture. Overgrazing or grazing when the soils are wet causes compaction of the surface layer and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and deferred grazing during wet periods help to keep the pasture in good condition.

Because of the ponding, the Lenawee Variant soil is generally unsuited to building site development and the Tappan soil is poorly suited. Surface or subsurface drainage methods help to lower the water table in the Tappan soil. The buildings should be constructed on well compacted fill material, which raises the site. Proper design and careful construction help to keep water away from basements.

Because of the ponding and the restricted permeability, these soils are generally unsuited to septic tank absorption fields. They are poorly suited to sewage lagoons because of the ponding. The lagoons should be protected from ponding and runoff water. Installing shallow surface drains and adding fill material to the berm around the lagoon help to control ponding and runoff.

The land capability classification is IIIw. The Michigan soil management groups are 2c-c and 2.5c-c.

65B—Fulton silty clay loam, 1 to 5 percent slopes. This nearly level to undulating, somewhat poorly drained soil is on broad plains and low knolls. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 7 inches thick. The subsoil is about 13 inches thick. The upper part is dark grayish brown, friable clay loam, and the lower part is dark yellowish brown, mottled, firm silty clay. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm, calcareous silty clay. In places the surface layer is darker and is more than 7 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Rapson and Wixom soils and the very poorly drained Latty soils. Rapson and Wixom soils are more droughty than the Fulton soil. They are in positions on the landscape similar to those of the Fulton soil. Latty soils are lower on the landscape than the Fulton soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is slow in the upper part of the Fulton soil and very slow in the lower part. Available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 1.0 to 2.5 feet during autumn, winter, and spring.

Most areas of this soil are used as cropland. A few are pastured or wooded.

This soil is fairly well suited to corn, beans, winter wheat, oats, and a mixture of grasses and legumes. The major management concerns are wetness, compaction, and erosion. Both surface and subsurface drainage systems are needed to reduce the wetness. Because of the restricted permeability, tile lines should be narrowly spaced and tile trenches should be backfilled with pervious material. Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits internal drainage and root development. As the natural soil structure is altered by compaction and excessive tillage, surface crusting becomes more severe. Conservation tillage, green manure crops, and incorporation of crop residue into the soil improve tilth and help to control erosion.

This soil is well suited to pasture. The major management concerns are wetness and compaction. Overgrazing or grazing when the soil is wet causes compaction and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to woodland. The major management concerns are seedling mortality, the windthrow hazard, and the equipment limitation. The losses of planted seedlings are high, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed. Operating harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is relatively dry or frozen.

Because of the wetness and the shrink-swell potential, this soil is poorly suited to building site development. Surface and subsurface drainage methods help to lower the water table. Enlarging excavations for buildings with basements and then backfilling with sandy material minimize shrink-swell damage. The included Wixom and Rapson soils are better sites for buildings.

Because of the wetness and the restricted permeability, this soil is generally unsuited to septic tank absorption fields. It is only fairly well suited to sewage lagoons because of the slope. Land shaping helps to overcome this limitation.

The land capability classification is IIIe. The Michigan soil management group is 1b.

66—Latty silty clay loam. This nearly level, very poorly drained soil is on flats and in depressions and drainageways. It is subject to ponding. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, firm silty clay loam about 10 inches thick. The subsoil is grayish brown and gray, mottled, very firm silty clay about 20 inches thick. The substratum to a depth of about 60 inches is grayish brown and gray, mottled, very firm, calcareous silty clay loam. In places the surface layer is darker.

Included with this soil in mapping are areas of the somewhat poorly drained Fulton soils. These soils are higher on the landscape than the Latty soil. They make up about 5 to 10 percent of the unit.

Permeability is slow in the upper part of the Latty soil and very slow in the lower part. Available water capacity is moderate. Surface runoff is very slow or ponded. The seasonal high water table is above or near the surface during winter and spring.

Most areas of this soil are used as cropland. A few are pastured or wooded.

This soil is fairly well suited to corn, beans, winter wheat, oats, and hay. The major management concerns are wetness and compaction. Both surface and subsurface drainage systems are needed to reduce the wetness. Because of the restricted permeability, tile lines should be narrowly spaced and tile trenches should be backfilled with pervious material. Working the soil when it is too wet results in cloddiness and compaction. Compaction inhibits root development. Conservation tillage, cover crops, and incorporation of crop residue into the soil improve tilth. As the natural soil structure is altered by compaction and excessive tillage, surface crusting becomes more severe.

Because of wetness and compaction, this soil is only fairly well suited to pasture. Overgrazing or grazing when the soil is wet causes compaction and destroys the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Operating harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is relatively dry or frozen. Losses of planted seedlings are high, and controlling windthrow is difficult. As a result, such harvest methods as selective cutting and strip cutting are needed. Windthrown trees should be periodically removed.

Because of the ponding and a high shrink-swell potential, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because of the ponding and the restricted permeability.

The land capability classification is IIIw. The Michigan soil management group is 1c.

67B—Pipestone fine sand, loamy substratum, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on low knolls and low ridges. Individual areas are irregularly shaped or linear and range from 4 to 60 acres in size.

Typically, the surface layer is very dark gray, very friable fine sand about 9 inches thick. The subsurface layer is dark grayish brown, very friable fine sand about 9 inches thick. The subsoil is strong brown, mottled, very friable fine sand about 30 inches thick. It has many small chunks of cemented soil. The substratum to a depth of about 60 inches is brown, mottled, firm, calcareous loam. In some places the sandy part of the profile is less than 40 inches thick. In other places the depth to loamy material is more than 60 inches.

Included with this soil in mapping are areas of the moderately well drained Covert and poorly drained Granby soils. Covert soils are on knolls. Granby soils are in depressions. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the upper part of the Pipestone soil and slow or moderately slow in the lower part. Available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet from late in fall to spring.

Most areas of this soil are used as cropland. Some are pastured or wooded.

This soil is fairly well suited to corn, beans, rye, and red clover. The major management concerns are wetness, soil blowing, and the organic matter content. Both surface and subsurface drainage systems are needed to reduce the wetness. The soil is often droughty in the summer. Irrigation may be needed. Windbreaks, rye buffer strips, cover crops, a cropping sequence that includes grasses and legumes, incorporation of crop residue into the soil, and regular additions of other organic material increase the organic matter content and the available water capacity and help to control soil blowing.

This soil is fairly well suited to pasture. The wetness is a limitation during some periods, and the droughtiness is a limitation during other periods. Overgrazing can destroy the cover of forage plants and increase the susceptibility to soil blowing. Restricted grazing during wet periods, proper stocking rates, and rotation or strip grazing help to keep the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard. Operating planting and harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is relatively dry or frozen. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of the wetness, this soil is poorly suited to building site development. Buildings can be constructed on well compacted fill material, which raises the site. Surface and subsurface drainage methods help to lower the water table.

Because of the wetness and the restricted permeability in the lower part of the profile, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as filling or mounding with suitable material, help to raise the absorption field above the water table. The soil is generally unsuited to sewage lagoons because of seepage and the wetness.

The land capability classification is IIIw. The Michigan soil management group is 5/2b.

69—Edwards-Adrian mucks. These nearly level, very poorly drained soils are on broad flats and in depressions. They are subject to ponding. Individual areas are irregular in shape and range from 10 to 450 acres in size. They are about 45 to 60 percent Edwards soil and 25 to 40 percent Adrian soil. The two soils occur as areas so small or so intricately mixed that mapping them separately is not practical.

Typically, the surface layer and subsurface layer of the Edwards soil are black, friable muck, which is about 26 inches thick. The substratum to a depth of about 60 inches is light gray and light brownish gray marl.

Typically, the surface layer and subsurface layer of the Adrian soil are black, friable muck, which is about 22 inches thick. The substratum to a depth of about 60 inches is yellowish brown and dark gray, mottled, very friable, calcareous loamy fine sand.

Permeability is moderately slow to moderately rapid in the organic part of the profile. It is rapid in the lower part of the Adrian soil. Available water capacity is high in both soils. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from late in fall to spring.

Most areas of these soils support wetland vegetation or are wooded. A few are pastured. Because of prolonged ponding, these soils are generally unsuited to cropland and are poorly suited to pasture. Proper stocking rates and restricted grazing during wet periods help to keep the pasture in good condition.

These soils are fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Harvesting equipment should be used only when the soils are frozen. Because losses of planted seedlings are high and controlling windthrow is difficult, such harvest methods as selective cutting and strip cutting are needed.

Because of the ponding and low strength, these soils are generally unsuited to building site development. They are generally unsuited to septic tank absorption fields because of the ponding. They are generally unsuited to sewage lagoons because of the ponding, seepage, and excess humus.

The land capability classification is Vw. The Michigan soil management groups are M/mc and M/4c.

71A—Rapson loamy fine sand, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on broad flats, low knolls, and low ridges. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is very dark gray, very friable loamy fine sand about 12 inches thick. The subsurface layer is grayish brown, very friable loamy fine sand about 3 inches thick. The subsoil is very friable loamy fine sand about 23 inches thick. The upper part is dark brown and mottled, the next part is yellowish brown and mottled, and the lower part is brown and dark yellowish brown. The substratum to a depth of about 60 inches is brown and grayish brown, mottled, friable, calcareous, stratified silt loam and loamy very fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford and Sanilac soils. Thetford soils are more droughty and Sanilac soils less droughty than the Rapson soil. Both soils are in landscape positions similar to those of the Rapson soil. They make up 3 to 10 percent of the unit.

Permeability is rapid in the upper part of the Rapson soil and moderate in the lower part. Available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet during winter and spring.

Most areas of this soil are used as cropland. Some are pastured or wooded.

This soil is fairly well suited to corn, soybeans, alfalfa, and small grain. The major management concerns are wetness, soil blowing, and the organic matter content. Both surface and subsurface drainage systems are needed to reduce the wetness. Fine sand and silt can plug tile lines. As a result, tile drainage systems should be designed so that the rate of flowing water helps to keep the tile lines clean. The soil is often droughty in summer. Irrigation may be needed. Windbreaks, rye buffer strips, cover crops, a cropping sequence that includes grasses and legumes, incorporation of crop residue into the soil, and regular additions of other organic material increase the organic matter content and help to control soil blowing. They also help to maintain tilth and conserve moisture.

This soil is well suited to pasture. The major management concern is the droughtiness. Overgrazing can destroy the cover of forage plants. Proper stocking rates and rotation or strip grazing help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard. Operating planting and harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is relatively dry or frozen. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of the wetness, this soil is poorly suited to building site development. Buildings can be constructed on well compacted fill material, which raises the site. Surface or subsurface drainage methods help to lower the water table.

Because of the wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields. Special construction methods, such as filling or mounding with suitable material, help to raise the absorption field above the water table and improve the filtering capacity. The soil is generally unsuited to sewage lagoons because of the wetness and seepage.

The land capability classification is IIIw. The Michigan soil management group is 4/2b-s.

75—Aquents, ponded. These very poorly drained, nearly level soils are in marshes and depressions on the margins of Saginaw Bay. Standing water is on the surface or the water table is very near the surface throughout the year, depending on the water level in Saginaw Bay. The unit occurs as one long area that is 1,759 acres in size.

The Aquents dominantly are calcareous and loamy. In places they have a surface layer and a subsoil and are sandy and calcareous in the upper part of the substratum.

Included with these soils in mapping are small areas of moderately well drained and well drained, loamy or sandy material obtained from dredged channels or from other off-site sources. These areas make up about 1 percent of the unit.

In most areas the vegetation consists of cattails, reeds, grasses, woody shrubs, and scattered clumps of water-tolerant trees. These soils are well suited to wetland wildlife habitat and to recreation uses. They provide habitat for migratory waterfowl and other aquatic and semiaquatic wildlife. In some areas the habitat for wildlife has been improved by dikes, measures that control water levels, and tillage.

These soils are not suited to building site development because of the prolonged ponding. The included soils are used as sites for roads, parks, and homes.

The land capability classification is VIIIw. No Michigan soil management group is assigned.

76—Pits. This map unit consists of open excavations from which soil and the underlying gravelly material have been or are being removed. The excavations are 4 to 50 feet deep, depending on the thickness of the gravelly deposit. In places the gravelly material has been removed to a depth below the water table. The bottom of the pits is nearly level to rolling. The sidewalls are generally steep. Individual areas are rectangular or irregularly shaped and range from 5 to 130 acres in size.

Most areas remain open pits. They can be reclaimed by land shaping, applying topsoil, and seeding grasses and legumes. The pits that contain water are suitable for some recreation uses.

This unit is not assigned to interpretive groups.

77—Aquents-Psamments complex, gently undulating. This map unit consists of very poorly and poorly drained Aquents and moderately well drained or excessively drained Psamments. The Aquents are in depressions and on other concave parts of the landscape. They are ponded in spring and fall or throughout the year. The Psamments are on the higher convex parts of the landscape. Individual areas are irregular in shape and range from 10 to 50 acres in size. They are about 15 to 75 percent Aquents, 15 to 75 percent Psamments, and 5 percent other soils. The soils occur as areas so small or so intricately mixed that mapping them separately is not practical.

The Aquents are in areas where sand and gravel have been excavated below the water table. They are generally loamy till but in some areas are sandy.

The Psamments are in areas where sandy material has been excavated. They are sandy. In some areas they have thin layers of loamy sand.

Included with these soils in mapping are areas that are used as sanitary landfills and are covered with loamy material. Also included are small areas of the somewhat excessively drained Chelsea and moderately well drained Covert and Ottokee soils. These soils have a definite profile. Included areas make up 3 to 5 percent of the unit.

The properties of the Aquents vary. They should be ascertained by onsite investigation. These soils have standing water on the surface or a water table near the surface throughout the year. The Psamments are rapidly permeable, have a low available water capacity, and have a water table at a depth of 2 to more than 6 feet.

The vegetation on the Aquents consists of cattails, reeds, grasses, woody shrubs, and scattered clumps of water-tolerant trees. Some small areas are denuded. Some are open water areas. These soils provide habitat for waterfowl and other aquatic wildlife. In some areas further excavation could create small lakes or ponds.

The old excavations are wooded or support woody shrubs and grasses. The idle excavations are denuded or support grasses. These areas can be restored to woodland or used as wildlife habitat. Planting drought-tolerant seedlings reduces the seedling mortality rate. Soil blowing is a hazard.

This unit is not assigned to interpretive groups.

78—Olentangy mucky silt loam. This nearly level, very poorly drained soil is in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 10 to 90 acres in size.

Typically, the surface layer is black, friable mucky silt loam about 10 inches thick. The substratum extends to a depth of 60 inches or more. In sequence downward, it is dark brown, firm mucky silt loam; dark gray, mottled, very firm silt loam; grayish brown, mottled, very firm, calcareous silt loam; light olive brown, mottled, very firm, calcareous silt loam; and olive, mottled, firm, calcareous silt loam. In places the surface layer is more than 16 inches thick.

Included with this soil in mapping are small areas of the poorly drained Tappan soils. These soils have a mineral profile. They are in the slightly higher landscape positions. They make up 3 to 5 percent of the unit.

Permeability is moderate in the Olentangy soil. Available water capacity is very high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface during autumn, winter, spring, and early summer.

Most areas of this soil are used as cropland. A few are pastured or support native vegetation.

This soil is fairly well suited to corn, soybeans, winter wheat, and sugar beets. The major management concerns are wetness, compaction, and the irreversible shrinkage of the organic layers. Both surface and subsurface drainage systems are needed to reduce the wetness. Shallow surface ditches are effective in removing surface water after heavy rains. Conservation tillage and deferred tillage when the soil is wet improve tilth.

Because of the wetness, this soil is only fairly well suited to pasture. Overgrazing or grazing when the soil is wet can destroy the cover of forage plants. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to woodland. The major management concerns are the equipment limitation, seedling mortality, plant competition, and the windthrow hazard. Operating planting and harvesting equipment is difficult during wet periods. The equipment should be used only when the soil is frozen. Because of seedling mortality, plant competition, and windthrow, selective cutting or strip cutting is needed.

Because of the ponding, low strength, and excess humus, this soil is generally unsuited to building site development, septic tank absorption fields, and sewage lagoons.

The land capability classification is IIIw. The Michigan soil management group is M/3.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 357,000 acres in the survey area, or nearly 68 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the northwestern part, mainly in associations 2, 3, 6, and 9, which are described under the heading "General Soil Map Units." About 300,000 acres of this prime farmland is used for crops. The crops grown on this land, mainly corn, soybeans, sugar beets, winter wheat, and field beans, account for an estimated two-thirds of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 6. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 5. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations, such as a seasonal high water table, frequent flooding during the growing season, or inadequate rainfall, qualify for prime farmland only in areas where these limitations have been overcome by such measures as drainage, flood control, or irrigation. The need for these measures is indicated after the map unit name in table 6. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Jerrell L. Lemunyon, agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 305,000 acres in Tuscola County was used for crops and pasture in 1980 (*5*). Of this total, about 127,000 acres was used for corn, 83,000 acres for dry beans, 45,500 acres for wheat, 22,700 acres for sugar beets, 14,000 acres for soybeans, 9,900 acres for oats, and 2,400 acres for barley. The rest was used mainly for hay and pasture. A small acreage was used for rye and sunflowers. The acreage used for field crops fluctuates greatly from year to year because of anticipated market prices, weather conditions, and the wide diversity of crops suited to the soils.

Numerous specialty crops are grown commercially in the county. A small acreage is used for cucumbers, potatoes, sweet corn, melons, and onions. Apples, strawberries, blueberries, and raspberries are the main fruit crops. Seed crops of corn, wheat and other small grain, and grasses are grown on some of the highly productive soils. Garden vegetables for home use are grown on most of the soils throughout the county. The latest information about growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Tuscola County ranks among the top counties in Michigan in crop production. Farms make up more than 69 percent of the total land area. Much of this farmland has a land capability classification of II, which implies only moderate limitations that are easily overcome. Crop production could be increased by applying soil and water conservation practices and crop production technology to all of the cropland in the county. Applicable management is given in the descriptions under the heading "Detailed Soil Map Units."

Many soil-related limitations or hazards are common to a large number of different soils. The measures that can overcome these limitations or hazards generally apply to many soils. The following paragraphs describe the concerns in managing the cropland and pasture in Tuscola County. The descriptions are arranged in an order that indicates the most cost effective priority to follow in overcoming the limitations or hazards. If both fertility and wetness are limitations, the measures used to improve fertility are not cost effective unless they are applied after the wetness is reduced.

Soil wetness is the major management concern on most of the cropland in the county. Some soils are too wet for crop production unless they are drained. Examples are the poorly drained Corunna, Essexville, Gilford, Tappan, and Tobico soils and the very poorly drained Houghton, Latty, Olentangy, Palms, and Wolcott soils.

Unless artificially drained, somewhat poorly drained soils are so wet that crops are damaged during most years. Examples are Capac, Londo, Pipestone, Thetford, and Wixom soils. Spring planting may be delayed by the seasonal high water table in moderately well drained soils, such as Covert soils, the moderately wet Guelph soils, and Ottokee soils. Random drainage systems may be needed on these soils. They also may be needed to drain wet spots, drainageways, and swales in areas of the well drained Boyer, Guelph, Marlette, Metea, and Spinks soils.

The design of both surface and subsurface drainage systems varies with the natural drainage, permeability, and texture of the soil. A combination of surface and subsurface drains is needed in most of the somewhat poorly drained, poorly drained, and very poorly drained soils. Sandy, rapidly permeable soils, such as Granby, Pipestone, and Thetford soils, can be overdrained if the space between the tile lines is not wide enough. In clayey, slowly permeable soils, such as Fulton and Latty soils, the tile lines should be more closely spaced and adequate surface drainage systems are needed. In some areas of poorly drained and very poorly drained soils, outlets for tile drainage systems are not readily available or water levels near Saginaw Bay are above the outlets. Catchments and lift pumps are needed in these areas.

Organic soils, such as the Houghton and Palms soils, oxidize and subside when their pore space is filled with air. As a result, special drainage systems are needed to control the depth and period of drainage. Keeping the water table at the level required by the crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of these soils.

When surface water enters large ditches, gullies can form on the ditchbanks. The surface water from surface drainage systems and from ponded areas can be lowered safely into ditches through drop pipe or a concrete box structure. Sugar beets and dry beans are examples of crops that are very sensitive to ponded water.

Information about the design of drainage systems for each kind of soil is available at local offices of the Soil Conservation Service.

Soil compaction is a major management concern on loamy soils, such as Capac, Londo, Shebeon, Tappan, and Wolcott soils. It can considerably lower crop yields. Intensive cultivation, especially when the soil is wet, can result in compaction. Because the crop rotations in the county include a high percentage of crops that produce a low amount of crop residue, only a small amount of organic material is returned to the soil. Crop rotations that include more grasses and legumes, green manure and cover crops, minimum tillage, and surface and subsurface drainage systems help to prevent excessive compaction.

Soil fertility is naturally high or medium in the loamy soils and low in most of the sandy soils. Many of the sandy soils are medium acid to neutral. Applications of ground limestone are needed on these soils to raise the pH to a level sufficient for good production of legumes and other crops that grow well only on nearly neutral soils. The calcareous Bach, Essexville, Lenawee Variant, Sanilac, Thomas, and Tobico soils have a neutral to moderately alkaline surface layer. These soils may have micronutrient deficiencies of manganese, zinc, and boron. Also, phosphorus may be unavailable for plant use. Alfalfa, corn, dry beans, and sugar beets are adversely affected by these deficiencies. Applying these nutrients in a band next to the seed at planting time helps to ensure sufficient availability. In some areas foliar spray is needed to correct the deficiencies. On all soils, the kinds and amounts of lime and fertilizer to be applied should be based on the results of soil tests and leaf analysis, on the need of the crop, and on the expected level of yields (*6*).

Water erosion is a major hazard on the undulating to rolling cropland in the county. It is a hazard on soils having a slope of more than 3 percent. Examples are Boyer, Chelsea, Guelph, Marlette, Metea, and Spinks soils.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on Guelph, Marlette, and other soils having a subsoil that is finer textured than that of other soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Boyer, Chelsea, and Spinks soils. Second, erosion on farmland results in sedimentation in streams. Controlling erosion minimizes this pollution and improves the quality of water for municipal and recreation uses and for fish and other wildlife.

On eroded spots in many sloping areas, preparing a good seedbed and tilling are difficult because the original friable surface layer has been lost. Such spots are on the upper parts of side slopes in areas of the gently rolling and rolling Guelph and Marlette soils.

Erosion-control practices provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a vegetative cover on the surface for extended periods can hold soil losses to an amount that does not reduce the productivity of the soils. On livestock farms, where pasture and hay are needed, including forage crops of grasses and legumes in the cropping sequence helps to control erosion on the more sloping land, provides nitrogen for the following crop, and improves tilth. In areas where surface water concentrates, permanent grassed waterways are needed to prevent the formation of gullies. In some fields sediment basins also are needed to reduce the amount of sediment in runoff water.

Soil blowing is a hazard on mucky or sandy soils, such as Avoco, Chelsea, Houghton, Palms, Pipestone, Spinks, and Wixom soils, and on soils that have a moderately coarse textured surface layer, such as Boyer, Corunna, and Metamora soils. It also is a hazard in some areas where the surface layer is finer textured, especially where the soil structure is poor because of excessive tillage. Soil blowing can damage the soils and crops in a very short period if winds are strong and the field is dry and bare of surface residue or vegetation. A surface mulch of crop residue or a cover crop can greatly reduce the hazard of soil blowing. Properly spaced grass barriers, small grain buffer strips, windbreaks, tillage methods that leave the surface rough, and irrigation of dry soils also help to control soil blowing.

Permanent pasture in the county occurs mostly as rolling and hilly soils that are subject to erosion or as wet soils that cannot be used for row crops because they are not adequately drained. The rolling and hilly soils are eroded in spots, and many are low to medium in fertility and are in poor tilth. Measures that control erosion are particularly important when the pasture is seeded. Examples are mulch seeding and a nurse crop. The need for lime and fertilizer should be determined by soil tests. Applying adequate amounts at seeding time and at regular intervals helps to ensure that the pasture stand has a long life.

A proper seeding mixture increases the productivity of permanent pasture. On well drained loams, such as Guelph and Marlette, a mixture of alfalfa, smooth bromegrass, and timothy is commonly used. On well drained or moderately well drained sandy loams and loamy sands, such as Boyer, Perrin, Ottokee, and Spinks, a mixture of alfalfa and smooth bromegrass or of smooth bromegrass and timothy is often used. In pastured areas where the soils range from well drained to poorly drained, a mixture of alfalfa, timothy, and red clover, of alfalfa, red cover, smooth bromegrass, and timothy, or of smooth bromegrass, timothy, and orchardgrass is commonly used. In undrained areas of wet, mineral soils, such as Gilford and Wolcott, either a mixture of smooth bromegrass and birdsfoot trefoil or smooth bromegrass alone is often used. On organic soils that have been drained, such as Houghton and Palms, the stand can be entirely bromegrass. In undrained areas of organic soils, it can be entirely reed canarygrass.

When a mixture of grasses and legumes is planted in the spring, applications of nitrogen fertilizer and an oat companion crop are beneficial. They generally are not used in areas where birdsfoot trefoil is seeded. No companion crop is needed when the pasture is seeded in summer. More specific information about seeding mixtures and times is available at local offices of the Cooperative Extension Service and the Soil Conservation Service.

The productivity of a pasture and its ability to protect the surface of the soil are influenced by the number of livestock that the pasture supports, the length of time that they graze, and the distribution of rainfall. Good pasture management includes stocking rates that maintain the desired forage species, pasture rotation, deferred grazing, and restricted grazing during wet and extremely dry periods.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 7. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 7 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*13*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main 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 very cold or very dry.

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

The acreage of soils in each capability class and subclass is shown in table 8. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table. Also given at the end of each map unit description is a Michigan soil management group. The soils are assigned to a group according to the need for lime and fertilizer and for artificial drainage and other practices (*8*). For soils making up a complex, the management groups are listed in the same order as the series named in the complex.

Woodland Management and Productivity

Virgin forest once covered almost all of Tuscola County. Nearly all of this woodland has been cleared for cultivation or lumber. Many areas of soils that are too steep, too wet, or too sandy for farming have returned to woodland through natural regeneration. Other areas where farming was not economical also have returned to woodland through natural regeneration. The soils in these areas can produce trees of high quality and volume if the woodland is managed properly.

Woodland currently makes up about 105,000 acres, or 20 percent of the county. About 75 percent of this acreage is state owned, and the rest is privately owned. The largest area of woodland is in association 8, which is described under the heading "General Soil Map Units." Other areas of woodland are in associations 4, 5, 7, 9, and 10. Woodlots are in scattered areas throughout the other associations. Plantations of red, white, jack, and Scotch pine and of Norway and white spruce are in scattered areas throughout the county. Christmas tree plantations and apple orchards are in a few areas.

The most common forest cover types in the uplands are aspen and mixed hardwoods. Aspen cover types are generally clearcut, and mixed hardwoods are marked for cutting individually or in groups. The most common forest cover types on lowlands are lowland hardwoods and a few swamp conifers. Some areas support only shrubs. The forest cover types are generally clearcut in very small blocks or strips. The trees can also be selected for cutting individually or in groups. Removing more than 30 to 40 percent of the volume in these areas can result in a windthrow hazard. The equipment limitation generally is a management concern because of the wetness. The equipment should be used only when the soils are relatively dry or frozen.

Many of the plantations and most of the commercial woodland could be improved by thinning the stand or harvesting mature trees. Removing overstocked trees and shrubs allows the more desirable trees to grow. Control of plant competition, pruning, fire protection, and control of disease and insects may also be needed to improve the woodland and to obtain sustained yields of firewood from woodlots. The Soil Conservation Service, the Michigan Department of Natural Resources, and the Cooperative Extension Service can help to determine specific woodland management needs.

Table 9 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 9, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over dense till should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Tuscola County has a varied population of fish and other wildlife. Whitetailed deer, squirrel, raccoon, and thrush inhabit the wooded areas. Quail, cottontail, pheasant, and many types of songbirds inhabit the farmed and open areas where food and cover are available. The streams and lakes in the county support salmon, trout, bass, pike, perch, and sunfish. The lakes and wetlands provide cover and feeding areas for ducks, swans, Canadian geese, and herons.

Many areas in the county can be improved as wildlife habitat by increasing the food supply and cover that wildlife need. These areas are in associations 1, 8, 9, and 10, which are described under the heading "General Soil Map Units."

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are rye, corn, wheat, oats, barley, and soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bromegrass, clover, alfalfa, and reed canarygrass.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are wild strawberries, goldenrod, dandelions, lambsquarters, and sumac.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, apple, hawthorn, wild grape, dogwood, hickory, blackberry, raspberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are honeysuckle, autumn-olive, crabapple, and American cranberrybush.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, hemlock, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, duckweed, rushes, sedges, reeds, cattails, and pondweed.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, ponds, level ditches, and potholes.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include pheasants, meadowlarks, field sparrows, cottontail rabbits, woodchucks, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, woodcock, thrushes, woodpeckers, tree squirrels, raccoon, deer, and nuthatches.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and und(cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel are less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, and rock fragments.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for embankments, dikes, and levees and for aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or of organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones. The performance of a system is affected by the depth of the root zone and by soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, and large stones affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, and slope affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

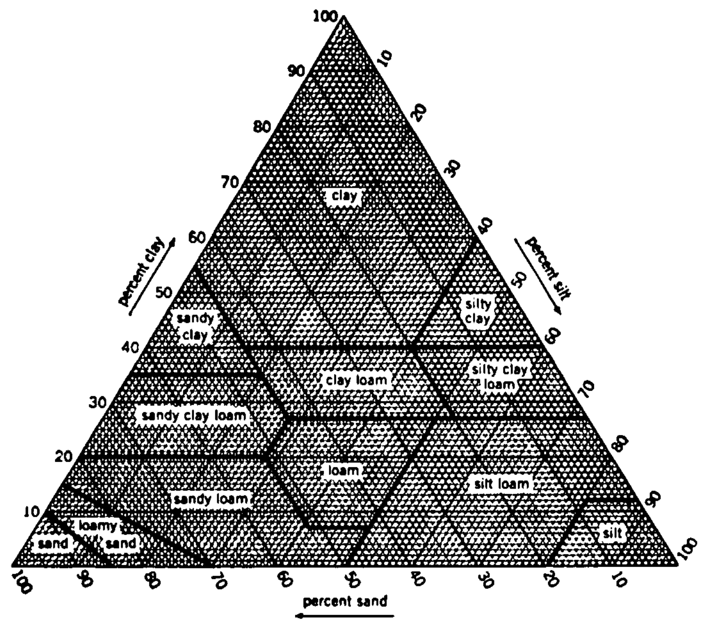


Figure 13.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 13). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 19, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 19 shows the expected total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Soil Characterization Data for Selected Soils

Many of the soils in Tuscola County were sampled and laboratory data determined by the Soil Research Laboratory, Ford Forestry Center, Michigan

Technological University, L'Anse, Michigan (*9*). The laboratory data obtained from the soil samples include analyses of particle-size distribution, coarse fragments, bulk density, and moisture retention. Complete chemical analyses were also performed on each sample, and spodic horizon criteria were determined on the appropriate samples. Standard National Cooperative Soil Survey procedures were used for all analyses. Samples of forest sites were used to estimate the productivity of many soils as woodland.

These data were used in classifying and correlating the soils and in evaluating their behavior, especially in forested areas. Seven profiles were selected as representative of their respective series. These series and their laboratory identification numbers are Capac (S81MI-157-4), Essexville (S81MI-157-5), Guelph (S81MI-157-1), Londo (S81MI-157-2), Marlette (S81MI-157-3), Shebeon (S81MI-157-7), and Tappan (S81MI-157-6).

In addition to the data from Tuscola County, soil characterization data and forest site data are available from nearby counties having many of the same soils that were not sampled in Tuscola County. These data and the data from Tuscola County are available at the Soil Research Laboratory, Ford Forestry Center, Michigan Technological University, L'Anse, Michigan; the Soil and Water Conservation Division, Michigan Department of Agriculture, Lansing, Michigan; and the Soil Conservation Service, State Office, East Lansing, Michigan.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*14*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*12*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*14*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Adrian Series

The Adrian series consists of very poorly drained soils in bogs on flood plains, outwash plains, and moraines. These soils formed in well decomposed organic material 16 to 50 inches deep over sandy material. Permeability is moderately slow to moderately rapid in the organic part of the soils and rapid in the sandy part. Slope is 0 to 2 percent.

Adrian soils are similar to Houghton and Palms soils and are commonly adjacent to Edwards, Houghton, and Palms soils. Edwards soils formed in organic deposits 16 to 50 inches deep over marl. They are in landscape positions similar to those of the Adrian soils. Houghton soils formed in organic deposits 51 inches or more thick. Palms soils formed in organic deposits 16 to 50 inches deep over loamy deposits.

Typical pedon of Adrian muck, in an area of Edwards-Adrian mucks, 150 feet east and 1,584 feet south of the northwest corner of sec. 35, T. 14 N., R. 11 E.

Oa1—0 to 11 inches; black (N 2/0), broken face, black (5YR 2/1), rubbed, sapric material; about 20 percent fiber, 10 percent rubbed; weak fine granular structure; friable; many very fine roots; less than 2 percent mineral material; neutral; clear wavy boundary.

Oa2—11 to 22 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 50 percent fiber, 9 percent rubbed; weak fine granular and weak thin platy structure; friable; less than 10 percent mineral material; neutral; abrupt wavy boundary.

C—22 to 26 inches; yellowish brown (10YR 5/6) loamy fine sand; common coarse distinct grayish brown (10YR 5/2) mottles; massive; very friable; mildly alkaline; abrupt irregular boundary.

Cg—26 to 60 inches; dark gray (10YR 4/1) loamy fine sand; common coarse distinct grayish brown (10YR 5/2) mottles; massive; very friable; moderately alkaline.

The depth to the sandy C horizon ranges from 16 to 50 inches. The organic material is neutral or mildly alkaline. It is dominantly herbaceous. The content of wood fragments is less than 10 percent.

The surface tier has hue of 7.5YR or 10YR or is neutral in hue. It has chroma of 0 to 3. The subsurface tier has hue of 5YR, 7.5YR, or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. The C horizon has value of 5 or 6 and chroma of 2 to 6. It is loamy fine sand, gravelly sand, or sand. The Cg horizon has value of 4 or 5 and chroma of 1 or 2. It is loamy fine sand, gravelly sand, or sand. It is mildly alkaline or moderately alkaline.

Avoca Series

The Avoca series consists of somewhat poorly drained soils on till plains and moraines. These soils formed in sandy material underlain by loamy material. Permeability is rapid in the upper part of the pedon and moderately slow in the lower part. Slope ranges from 0 to 3 percent.

Avoca soils are similar to Rapson soils and are commonly adjacent to Corunna, Essexville, Londo, and Tappan soils. The lower part of Rapson soils is silty and is more stratified than that of the Avoca soils. Corunna soils are poorly drained and are finer textured in the upper part than the Avoca soils. Essexville soils are poorly drained and are calcareous in the upper part. Londo soils are finer textured in the upper part than the Avoca soils. They are in landscape positions similar to those of the Avoca soils. Tappan soils are poorly drained, are calcareous, and are finer textured in the upper part than the Avoca soils. Corunna, Essexville, and Tappan soils are in the lower positions on the landscape.

Typical pedon of Avoca loamy fine sand, in an area of Tappan-Avoca complex, 0 to 3 percent slopes, 1,450 feet north and 390 feet west of the southeast corner of sec. 20, T. 13 N., R. 9 E.

Ap—0 to 11 inches; dark brown (10YR 3/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

Bs—11 to 20 inches; dark brown (7.5YR 3/4) loamy fine sand; many coarse faint dark yellowish brown (10YR 4/4) and dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable; few medium chunks of weakly cemented ortstein; neutral; abrupt wavy boundary.

2C1—20 to 24 inches; brown (10YR 5/3) loam; few fine distinct gray (10YR 5/1) mottles; massive; friable; slight effervescence; neutral; abrupt irregular boundary.

2C2—24 to 60 inches; brown (10YR 5/3) loam; few fine distinct gray (10YR 5/1) and dark gray (10YR 4/1) mottles; massive; friable; strong effervescence; moderately alkaline.

The depth to the 2C horizon ranges from 18 to 40 inches. The solum is medium acid to mildly alkaline. It has a pebble content of 0 to 10 percent.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes loamy sand and fine sand. Some pedons have an E horizon. This horizon has value of 5 or 6 and chroma of 2 or 3. It is sand, loamy fine sand, or fine sand. The Bs horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is fine sand, sand, or loamy fine sand. The content of small ortstein fragments in this horizon ranges from 0 to 20 percent. Some pedons have a C1 horizon. The 2C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is loam, silt loam, clay loam, or silty clay loam. It is neutral to moderately alkaline. It has a pebble content of 2 to 5 percent.

Bach Series

The Bach series consists of poorly drained, moderately permeable soils on lake plains. These soils formed in loamy, calcareous lacustrine deposits. Slope is 0 to 2 percent.

These soils have a mollic surface layer, which is not definitive for the Bach series. This difference, however, does not alter the usefulness or behavior of the soils.

Bach soils are similar to Pella soils and are commonly adjacent to Rapson, Sanilac, and Tappan soils. Pella soils are finer textured throughout than the Bach soils and are noncalcareous in the upper part. Rapson soils are somewhat poorly drained, are noncalcareous in the upper part, and are coarser textured than the Bach soils. Sanilac soils are somewhat poorly drained. Rapson and Sanilac soils are in the higher positions on the landscape. Tappan soils are finer textured than the Bach soils. They are slightly higher on the landscape than the Bach soils.

Typical pedon of Bach very fine sandy loam, 2,185 feet south and 255 feet west of the center of sec. 31, T. 14 N., R. 11 E.

Ap—0 to 14 inches; very dark gray (10YR 3/1) very fine sandy loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; firm; strong effervescence; mildly alkaline; abrupt wavy boundary.

Bg—14 to 23 inches; dark grayish brown (2.5Y 4/2) very fine sandy loam; common medium distinct very dark grayish brown (10YR 3/2) and dark yellowish brown (10YR 4/4) mottles; weak very fine subangular blocky structure; firm; slight effervescence; mildly alkaline; clear wavy boundary.

Cg—23 to 35 inches; gray (10YR 5/1) very fine sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; strong effervescence; mildly alkaline; abrupt wavy boundary.

C1—35 to 41 inches; light brownish gray (10YR 6/2) very fine sandy loam; few medium faint grayish brown (10YR 5/2) mottles; massive; firm; violent effervescence; mildly alkaline; abrupt wavy boundary.

C2—41 to 60 inches; light brownish gray (10YR 6/2) very fine sandy loam; few fine distinct dark yellowish brown (10YR 4/4) and dark yellowish brown (10YR 3/4) mottles; massive; firm; about 3 percent pebbles; violent effervescence; mildly alkaline.

The solum is 20 to 30 inches thick. It is neutral to moderately alkaline.

The Ap horizon has hue of 10YR or 5Y, value of 2 or 3, and chroma of 1 or 2. It is dominantly very fine sandy loam, but the range includes fine sandy loam, silt loam, and loam. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1 or 2. It is very fine sandy loam, silt loam, or silt. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 3. It is very fine sandy loam or silt loam.

Belleville Series

The Belleville series consists of poorly drained soils on till plains and lake plains. These soils formed in sandy material underlain by loamy material. Permeability is rapid in the upper part of the pedon and moderately slow in the lower part. Slope is 0 to 2 percent.

Belleville soils are similar to Essexville soils and are commonly adjacent to Corunna, Granby, Wolcott, and Wixom soils. Essexville soils are calcareous in the upper part. Corunna soils are finer textured in the upper part than the Belleville soils. Granby soils are sandy throughout. Wolcott soils are finer textured in the upper part than the Belleville soils. Corunna, Granby, and Wolcott soils are in landscape positions similar to those of the Belleville soils. Wixom soils are somewhat poorly drained and are slightly higher on the landscape than the Belleville soils.

Typical pedon of Belleville loamy fine sand, in an area of Wixom-Belleville loamy fine sands, 0 to 3 percent slopes, 1,450 feet north and 885 feet west of the southeast corner of sec. 35, T. 14 N., R. 11 E.

A—0 to 10 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; slightly acid; abrupt wavy boundary.

Bg—10 to 17 inches; grayish brown (2.5Y 5/2) loamy fine sand; massive; uncoated sand grains; very friable; dark grayish brown (10YR 4/2) organic stains in many root channels and cracks; slightly acid; clear wavy boundary.

BC—17 to 22 inches; brown (10YR 5/3) loamy fine sand; few fine distinct strong brown (7.5YR 4/6) mottles; massive; very friable; neutral; abrupt wavy boundary.

2C—22 to 60 inches; brown (10YR 5/3) loam; common medium distinct gray (N 6/0) and dark brown (7.5YR 3/2) and few fine prominent strong brown (7.5YR 4/6) and reddish yellow (7.5YR 7/8) mottles; massive; firm; mildly alkaline.

The solum ranges from 18 to 30 inches in thickness. It is slightly acid to mildly alkaline. The depth to the 2C horizon ranges from 20 to 40 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes sand, fine sand, and loamy sand. The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is loamy fine sand, sand, fine sand, or loamy sand. Some pedons have a C1 horizon. This horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is loamy fine sand, sand, fine sand, or loamy sand. In some pedons a thin layer of gravel is above the 2C horizon. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 6. It is loam, silt loam, clay loam, or silty clay loam. It is mildly alkaline or moderately alkaline.

Boyer Series

The Boyer series consists of well drained soils on outwash plains, old beach ridges, and moraines. These soils formed in sandy and loamy material. Permeability is moderately rapid in the upper part of the pedon and very rapid in the lower part. Slope ranges from 0 to 12 percent.

In most areas these soils have a mollic surface layer, which is not definitive for the Boyer series. This difference, however, does not alter the usefulness or behavior of the soils.

Boyer soils are similar to Metea and Perrin soils and are commonly adjacent to Gilford, Perrin, Spinks, and Wasepi soils. Metea soils are finer textured in the lower part than the Boyer soils. Perrin soils are moderately well drained. Gilford soils are very poorly drained and are in depressions and drainageways. Spinks soils have an argillic horizon of lamellae and are in landscape positions similar to those of the Boyer soils. Wasepi soils are somewhat poorly drained and are in the lower positions on the landscape.

Typical pedon of Boyer sandy loam, 0 to 6 percent slopes, 1,388 feet west and 185 feet south of the northeast corner of sec. 25, T. 14 N., R. 11 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; abundant fine roots; about 10 percent pebbles; neutral; abrupt smooth boundary.

E—8 to 18 inches; dark yellowish brown (10YR 4/4) loamy sand; very weak fine granular structure; very friable; few fine roots; about 10 percent pebbles; mildly alkaline; abrupt irregular boundary.

Bt—18 to 28 inches; dark yellowish brown (10YR 3/4) gravelly sandy loam; very weak medium subangular blocky structure; friable; few light gray (10YR 7/2) lime streaks; few fine roots; about 20 percent pebbles; neutral; abrupt irregular boundary.

2C—28 to 60 inches; brown (10YR 5/3) gravelly sand; single grain; loose; about 30 percent pebbles; mildly alkaline; strong effervescence.

The solum ranges from 24 to 40 inches in thickness. It is medium acid to mildly alkaline. The content of pebbles ranges from 1 to 20 percent in the solum.

The Ap horizon has chroma of 2 or 3. It is dominantly sandy loam, but the range includes loamy sand, gravelly sandy loam, and gravelly loamy sand. The E horizon has value of 4 or 5 and chroma of 4 to 6. It is loamy sand, sandy loam, or the gravelly or very gravelly analogs of these textures. The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam, gravelly sandy loam, sandy clay loam, or loam. The 2C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is gravelly sand, gravelly loamy sand, or stratified sand and gravel. The content of pebbles in this horizon is 15 to 50 percent, and that of cobbles is 1 to 5 percent.

Capac Series

The Capac series consists of somewhat poorly drained, moderately slowly permeable soils on till plains and moraines. These soils formed in loamy glacial till. Slope ranges from 0 to 5 percent.

Capac soils are similar to Metamora and Shebeon soils and are commonly adjacent to Marlette, Metamora, Wolcott, and Wixom soils. Metamora and Wixom soils are coarser textured in the upper part than the Capac soils. They are in landscape positions similar to those of the Capac soils. Shebeon soils have a solum that is thinner than that of the Capac soils and have a dense layer of loamy till. Marlette soils are well drained and are in the higher positions on the landscape. Wolcott soils are very poorly drained and in the lower positions on the landscape.

Typical pedon of Capac loam, 1 to 5 percent slopes, 2,630 feet north and 157 feet west of the southeast corner of sec. 36, T. 12 N., R. 11 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

B/E—10 to 13 inches; dark yellowish brown (10YR 4/4) loam (Bt); grayish brown (10YR 5/2) coatings of loam (E), 1 to 5 millimeters thick, on vertical faces of peds; weak fine angular blocky structure; friable; thin dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; abrupt irregular boundary.

Bt1—13 to 26 inches; dark yellowish brown (10YR 4/4) clay loam; many medium prominent dark gray (10YR 4/1) mottles; weak fine angular blocky structure; firm; thin dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; abrupt irregular boundary.

Bt2—26 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; many medium prominent gray (10YR 5/1) and many fine and medium distinct yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; firm; thin dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear irregular boundary.

C—32 to 60 inches; yellowish brown (10YR 5/4) loam; common fine faint brownish yellow (10YR 6/6) mottles; many fine prominent gray (10YR 6/1) and light gray (10YR 7/1) lime coatings; massive; firm; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 26 to 34 inches. The solum is medium acid to neutral. The content of pebbles ranges from 0 to 5 percent in the solum.

The Ap horizon has value of 3 or 4. It is dominantly loam, but the range includes sandy loam. Some pedons have an E horizon. This horizon has value of 5 or 6 and chroma of 1 to 3. It is loam or sandy loam. The B horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or clay loam. The C horizon also is loam or clay loam. It has value of 5 or 6 and chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

Chelsea Series

The Chelsea series consists of somewhat excessively drained, rapidly permeable soils on moraines, outwash plains, and old beach ridges. These soils formed in sandy deposits. Slope ranges from 0 to 12 percent.

Chelsea soils are similar to Ottokee soils and are commonly adjacent to Ottokee, Spinks, and Thetford soils. Ottokee soils are moderately well drained and are slightly lower on the landscape than the Chelsea soils. Spinks soils are well drained and have more lamallae than the Chelsea soils. They are in landscape positions similar to those of the Chelsea soils. Thetford soils have more lamellae than the Chelsea soils. They are somewhat poorly drained and are in the lower positions on the landscape.

Typical pedon of Chelsea fine sand, 0 to 6 percent slopes, 700 feet east and 1,200 feet north of the southwest corner of sec. 36, T. 14 N., R. 11 E.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sand, light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; slightly acid; abrupt wavy boundary.

Bw1—5 to 18 inches; strong brown (7.5YR 5/6) fine sand; single grain; loose; slightly acid; gradual wavy boundary.

Bw2—18 to 38 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; slightly acid; gradual wavy boundary.

E—38 to 50 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; neutral; clear wavy boundary.

E&Bt—50 to 60 inches; yellowish brown (10YR 5/4) fine sand (E); single grain; loose; dark yellowish brown (10YR 4/4) loamy fine sand lamellae (Bt) 0.5 inch to 2.0 inches thick; weak thin platy and medium subangular blocky structure; very friable; clay bridging between sand grains; neutral.

The solum ranges from 48 to more than 60 inches in thickness. It is medium acid to neutral. The depth to the uppermost lamella ranges from 27 to 55 inches.

The A or Ap horizon has value of 2 to 4 (6 or more dry) and chroma of 1 to 6. It is dominantly fine sand, but the range includes loamy fine sand, loamy sand, and sand. The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is fine sand or sand. The E horizon and the E part of the E&B horizon have value of 5 or 6. They are fine sand or sand. The Bt part of the E&B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loamy fine sand or sandy loam.

Cohoctah Series

The Cohoctah series consists of very poorly drained, moderately rapidly permeable soils on flood plains. These soils formed in loamy and sandy alluvial deposits. Slope is 0 to 2 percent.

Cohoctah soils are commonly adjacent to Pipestone, Sloan, Tappan, and Wixom soils. Pipestone soils are somewhat poorly drained, are coarser textured throughout than the Cohoctah soils, and are in the higher positions on the landscape. Sloan soils are finer textured than the Cohoctah soils. They are in positions on the landscape similar to those of the Cohoctah soils. Tappan soils are poorly drained and are finer textured throughout than the Cohoctah soils. Wixom soils are somewhat poorly drained and are coarser textured in the upper part than the Cohoctah soils. Tappan and Wixom soils are in the slightly higher positions on the landscape.

Typical pedon of Cohoctah sandy loam, 132 feet east and 980 feet south of the northwest corner of sec. 28, T. 14 N., R. 11 E.

Ap—0 to 18 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; mildly alkaline; abrupt wavy boundary.

A2—18 to 23 inches; very dark brown (10YR 2/2) sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; mildly alkaline; abrupt wavy boundary.

Cg1—23 to 31 inches; dark gray (10YR 4/1) loamy sand; few fine faint very dark grayish brown (10YR 3/2) mottles; weak medium subangular blocky structure; friable; common thin very dark gray (10YR 3/1) organic-enriched lenses; moderately alkaline; abrupt wavy boundary.

Cg2—31 to 35 inches; dark grayish brown (10YR 4/2) sandy loam; common medium faint dark gray (10YR 4/1) mottles; weak medium subangular blocky structure; friable; few thin very dark gray (10YR 3/1) organic-enriched lenses; mildly alkaline; abrupt wavy boundary.

Cg3—35 to 57 inches; dark grayish brown (10YR 4/2) gravelly sandy loam grading with depth to gravelly loamy sand; few fine faint brown (10YR 4/3) mottles; massive; friable; few thin dark gray (10YR 4/1) organic-enriched lenses; about 25 percent pebbles; mildly alkaline; gradual wavy boundary.

C—57 to 60 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand; few fine distinct dark grayish brown (10YR 4/2) mottles; single grain; loose; about

15 percent pebbles; slight effervescence; mildly alkaline.

Reaction is neutral to moderately alkaline in the upper 30 inches and mildly alkaline or moderately alkaline below a depth of 30 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly sandy loam, but the range includes loamy sand, fine sandy loam, and loamy fine sand. The Cg horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 3 to 6, and chroma of 1 or 2. It is sandy loam, gravelly sandy loam, fine sandy loam, loamy fine sand, gravelly loamy sand, or loam. The C horizon has value of 3 to 5 and chroma of 3 or 4. It is dominantly very fine sandy loam, sandy loam, gravelly sandy loam, gravelly loamy sand, or loam. In some pedons, however, it has thin layers of sand, loam, or silt loam.

Corunna Series

The Corunna series consists of poorly drained soils on lake plains and till plains. These soils formed in loamy deposits. Permeability is moderate or moderately rapid in the upper part of the pedon and moderately slow in the lower part. Slope is 0 to 2 percent.

Corunna soils are similar to Gilford soils and are commonly adjacent to Londo, Metamora, Tappan, and Wixom soils. Gilford soils have a substratum that is coarser textured than that of the Corunna soils. Londo soils are somewhat poorly drained and are finer textured in the upper part than the Corunna soils. Metamora soils are somewhat poorly drained. Tappan soils are finer textured in the upper part than the Corunna soils. They are in landscape positions similar to those of the Corunna soils. Wixom soils are somewhat poorly drained and are coarser textured in the upper part than the Corunna soils. Londo, Metamora, and Wixom soils are in the slightly higher landscape positions.

Typical pedon of Corunna sandy loam, 285 feet west and 1,490 feet south of the northeast corner of sec. 8, T. 10 N., R. 7 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

Bg1—10 to 20 inches; dark grayish brown (2.5Y 4/2) sandy loam; common fine distinct light brownish gray (2.5Y 6/2) and gray (10YR 6/1) mottles; weak medium subangular blocky structure; very friable; slightly acid; abrupt irregular boundary.

Bg2—20 to 33 inches; grayish brown (10YR 5/2) sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; slightly acid; abrupt wavy boundary.

2Cg1—33 to 47 inches; dark grayish brown (10YR 4/2) loam; many medium faint brown (10YR 4/3) mottles; weak medium angular blocky structure; friable; strong effervescence; mildly alkaline; abrupt wavy boundary.

2Cg2—47 to 60 inches; grayish brown (10YR 5/2) loam; common medium prominent dark yellowish brown (10YR 4/4) mottles; massive; firm; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 26 to 40 inches. The solum is slightly acid to mildly alkaline. The content of pebbles and cobbles ranges from 0 to 10 percent in the solum.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly sandy loam, but the range includes fine sandy loam and loam. The Bg horizon has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is sandy loam, fine sandy loam, loam, or loamy fine sand. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 6. It is loam, clay loam, or silty clay loam. It is mildly alkaline or moderately alkaline.

Covert Series

The Covert series consists of moderately well drained, rapidly permeable soils on outwash plains and old beach ridges. These soils formed in sandy glaciofluvial deposits. Slope ranges from 0 to 6 percent.

Covert soils are commonly adjacent to Chelsea, Pipestone, and Wixom soils. Chelsea soils are somewhat excessively drained and have a B horizon of lamellae. They are in the higher positions on the landscape. Pipestone and Wixom soils are somewhat poorly drained and are in the lower positions on the landscape. Wixom soils have an E horizon between the upper subsoil and the lower subsoil and have a loamy substratum.

Typical pedon of Covert sand, 0 to 6 percent slopes, 2,231 feet west and 1,505 feet north of the southeast corner of sec. 35, T. 14 N., R. 9 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) sand, brown (10YR 5/3) dry; weak fine granular structure; very friable; common fine roots; medium acid; abrupt wavy boundary.

Bs1—7 to 14 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; medium acid; clear wavy boundary.

Bs2—14 to 24 inches; strong brown (7.5YR 4/6) sand; single grain; loose; medium acid; abrupt wavy boundary.

BC—24 to 41 inches; brown (10YR 5/3) sand; few fine faint dark grayish brown (10YR 4/2) mottles; single grain; loose; few fine prominent black (10YR 2/1) iron-magnesium accumulations; medium acid; abrupt wavy boundary.

C—41 to 60 inches; yellowish brown (10YR 5/4) sand; common medium distinct strong brown (7.5YR 5/6) mottles; single grain; loose; few fine dark yellowish brown (10YR 4/6) horizontal streaks; slightly acid.

The solum ranges from 30 to 45 inches in thickness. It is neutral to medium acid. The content of pebbles ranges from 0 to 5 percent in the solum.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2. It is dominantly sand, but the range includes loamy sand. The B horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. The content of small fragments of ortstein in this horizon ranges from 0 to 20 percent. Some pedons do not have a BC horizon. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is dominantly sand, but the range includes fine sand. This horizon ranges from slightly acid to moderately alkaline.

Edwards Series

The Edwards series consists of very poorly drained soils in bogs on outwash plains, till plains, and moraines. These soils formed in well decomposed organic material 16 to 50 inches deep over marl. Permeability is moderately slow to moderately rapid in the organic material. Slope is 0 to 2 percent.

Edwards soils are similar to Houghton soils and are commonly adjacent to Adrian, Houghton, and Palms soils. The adjacent soils are in landscape positions similar to those of the Edwards soils. Adrian soils formed in organic deposits 16 to 50 inches deep over sandy deposits. Houghton soils formed in organic deposits 51 or more inches thick. Palms soils formed in organic deposits 16 to 50 inches deep over loamy deposits.

Typical pedon of Edwards muck, in an area of Edwards-Adrian mucks, 100 feet south and 1,350 feet east of the northwest corner of sec. 35, T. 14 N., R. 11 E.

Oa—0 to 26 inches; black (10YR 2/1), broken face, rubbed, and pressed, sapric material; about 5 percent fiber before rubbing and 1 percent after; herbaceous fibers; weak fine granular structure; friable; yellowish brown (10YR 5/4) sodium pyrophosphate; many fine and medium roots; mildly alkaline; clear wavy boundary.

C—26 to 60 inches; light gray (10YR 7/2) and light brownish gray (10YR 6/2) marl; massive; few fine roots; violent effervescence; moderately alkaline.

The depth to the C horizon ranges from 16 to 50 inches. The organic material is neutral or mildly alkaline. It is derived primarily from herbaceous plants. The content of wood fragments ranges from 0 to 10 percent.

The Oa horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly sapric material; however, thin hemic layers are in some pedons. The C horizon has hue of 10YR, value of 5 to 8, and chroma of 1 or 2. It is mildly alkaline or moderately alkaline.

Essexville Series

The Essexville series consists of poorly drained soils on till plains and lake plains. These soils formed in sandy material underlain by loamy material. Permeability is rapid in the upper part of the pedon and moderately slow in the lower part. Slope is 0 to 2 percent.

Essexville soils are similar to Belleville soils and are commonly adjacent to Avoca and Tappan soils. Belleville soils are noncalcareous in the upper part. Avoca soils are somewhat poorly drained, are noncalcareous, and are in the slightly higher positions on the landscape. Tappan soils are finer textured than the Essexville soils. They are in landscape positions similar to those of the Essexville soils.

Typical pedon of Essexville loamy fine sand, 300 feet north and 100 feet east of the southwest corner of sec. 13, T. 14 N., R. 7 E.

Ap—0 to 12 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

Bg—12 to 16 inches; dark grayish brown (2.5Y 4/2) fine sand; few fine distinct dark yellowish brown (10YR 4/4) mottles; single grain; loose; uncoated sand grains; strong effervescence; mildly alkaline; abrupt wavy boundary.

C1—16 to 26 inches; pale brown (10YR 6/3) fine sand; single grain; loose; strong effervescence; mildly alkaline; abrupt wavy boundary.

C2—26 to 30 inches; grayish brown (10YR 5/2) fine sand; single grain; loose; strong effervescence; mildly alkaline; abrupt wavy boundary.

2C3—30 to 42 inches; brown (10YR 5/3) loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; very weak fine angular blocky structure; firm; many fine distinct white (10YR 8/2) lime coatings; strong effervescence; moderately alkaline; abrupt wavy boundary.

2C4—42 to 48 inches; grayish brown (10YR 5/2) loam; weak thin platy structure parting to very weak very fine angular blocky; firm; many fine faint brown (10YR 5/3) centers of peds; dark grayish brown (10YR 4/2) coatings; strong effervescence; moderately alkaline; abrupt wavy boundary.

2C5—48 to 60 inches; grayish brown (10YR 5/2) loam; common fine distinct brown (10YR 5/3) mottles; appears massive but has weak thin bedding planes; firm; few fine prominent gray (N 5/0) lime streaks and crack fillings; strong effervescence; moderately alkaline.

The depth to the 2C horizon ranges from 18 to 40 inches. The depth to effervescent material is 0 to 10 inches. The content of pebbles is 0 to 10 percent in the upper sandy part of the pedon.

The Ap horizon has value of 2 or 3 and chroma of 0 to 2. It is dominantly loamy fine sand, but the range includes fine sand, sand, and loamy sand. The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is fine sand, loamy fine sand, sand, or loamy sand. Some pedons do not have a Bg horizon. The C horizon has value of 4 to 6 and chroma of 1 to 4. It is fine sand, loamy fine sand, sand, or loamy sand. The 2C horizon has hue of 2.5Y, 10YR, or 7.5YR, value of 4 or 5, and chroma of 1 to 4. It is loam or silty clay loam.

Fulton Series

The Fulton series consists of somewhat poorly drained soils in areas of old glacial lakebeds and plains. These soils formed in loamy and clayey lacustrine sediments. Permeability is slow in the upper part of the pedon and very slow in the lower part. Slope ranges from 1 to 5 percent.

Fulton soils are similar to Shebeon soils and are commonly adjacent to Latty, Rapson, and Wixom soils. Shebeon soils are loamy throughout. Latty soils are poorly drained and are in the lower positions on the landscape. Rapson and Wixom soils are sandy in the upper part. They are in the slightly higher positions on the landscape.

Typical pedon of Fulton silty clay loam, 1 to 5 percent slopes, 1,750 feet north and 1,100 feet west of the southeast corner of sec. 35., T. 11 N., R. 10 E.

Ap—0 to 7 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; moderate fine angular blocky and moderate medium granular structure; friable; neutral; abrupt smooth boundary.

BA—7 to 12 inches; dark grayish brown (2.5Y 4/2) clay loam; moderate medium angular blocky and moderate medium granular structure; friable; many distinct thin grayish brown (2.5Y 5/2) clay films on faces of peds; neutral; abrupt wavy boundary.

Bt—12 to 20 inches; dark yellowish brown (10YR 4/4) silty clay; many medium faint yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate fine and medium angular blocky; firm; many distinct thin gray (10YR 5/1) clay films on faces of peds; neutral; abrupt wavy boundary.

C1—20 to 39 inches; yellowish brown (10YR 5/4) silty clay; many coarse distinct gray (2.5Y 5/1) and common coarse distinct olive gray (5Y 5/2) mottles; appears massive but has distinct thin bedding planes; firm; strong effervescence; mildly alkaline; clear wavy boundary.

C2—39 to 60 inches; yellowish brown (10YR 5/4) silty clay; few medium faint yellowish brown (10YR 5/6) and common medium and coarse distinct olive gray (5Y 5/2) mottles; appears massive but has distinct thin bedding planes; firm; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 39 inches. The A horizon has hue of 10YR or 2.5Y and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes silt loam, silty clay, and fine sandy loam. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is silty clay or clay. It is neutral or mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 6. It is stratified silty clay, clay, or silty clay loam.

Gilford Series

The Gilford series consists of very poorly drained soils on outwash plains and lake plains. These soils formed in loamy material underlain by sandy material. Permeability is moderately rapid in the upper part of the pedon and very rapid in the lower part. Slope is 0 to 2 percent.

Gilford soils are similar to Corunna soils and are commonly adjacent to Boyer, Guelph, Londo, and Wasepi soils. The adjacent soils are in the higher positions on the landscape. Corunna soils are finer textured in the lower part than the Gilford soils. Boyer soils are well drained. Guelph and Londo soils are finer textured throughout than the Gilford soils. Guelph soils are well drained or moderately well drained, and Londo soils are somewhat poorly drained. Wasepi soils are somewhat poorly drained.

Typical pedon of Gilford sandy loam, 1,220 feet west and 100 feet south of the northeast corner of sec. 25, T. 13 N., R. 8 E.

A—0 to 11 inches; black (10YR 2/1) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; mildly alkaline; abrupt smooth boundary.

Bg1—11 to 15 inches; dark grayish brown (2.5Y 4/2) sandy loam; common medium distinct grayish brown (10YR 5/2) and brown (10YR 4/3) mottles; weak medium subangular blocky structure; friable; slight effervescence; mildly alkaline; abrupt irregular boundary.

Bg2—15 to 29 inches; dark grayish brown (2.5Y 4/2) sandy loam; few coarse prominent grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6), and olive yellow (2.5Y 6/6) mottles; weak medium and coarse subangular blocky structure; friable; strong effervescence; mildly alkaline; abrupt wavy boundary.

2C—29 to 60 inches; stratified grayish brown (2.5Y 5/2) fine sand and dark grayish brown (2.5Y 4/2) gravelly sand; single grain; loose; about 25 percent pebbles; strong effervescence; mildly alkaline.

The solum ranges from 22 to 40 inches in thickness. It is mildly alkaline or moderately alkaline. The content of pebbles ranges from 10 to 25 percent in the solum and from 5 to 35 percent in the substratum.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly sandy loam, but the range includes loam, fine sandy loam, loamy sand, and mucky sandy loam. The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 2. It is dominantly loam, fine sandy loam, or sandy loam. In some pedons, however, it has thin layers of sandy clay loam. The 2C horizon has value of 5 or 6 and chroma of 1 to 3. It is sand, gravelly sand, gravelly loamy sand, or stratified fine sand and gravel.

Granby Series

The Granby series consists of poorly drained, rapidly permeable soils on outwash plains and lake plains. These soils formed in sandy glaciofluvial material. Slope is 0 to 2 percent.

Granby soils are similar to Tobico soils and are commonly adjacent to Pipestone and Thetford soils. Tobico soils are calcareous in the upper part. Pipestone soils are somewhat poorly drained. Thetford soils are somewhat poorly drained and have an argillic horizon of lamellae. Pipestone and Thetford soils are in the higher positions on the landscape.

Typical pedon of Granby loamy fine sand, 1,110 feet east and 255 feet north of the southwest corner of sec. 32, T. 12 N., R. 8 E.

A—0 to 11 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; neutral; abrupt smooth boundary.

Bg1—11 to 16 inches; dark grayish brown (2.5Y 4/2) loamy fine sand; common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; neutral; abrupt wavy boundary.

Bg2—16 to 40 inches; dark grayish brown (2.5Y 4/2) loamy fine sand; common medium prominent dark yellowish brown (10YR 3/6) mottles; weak medium subangular blocky structure; very friable; neutral; abrupt wavy boundary.

C—40 to 45 inches; olive brown (2.5Y 4/4) fine sand; many medium distinct dark grayish brown (2.5Y 4/2) mottles; single grain; loose; mildly alkaline; abrupt wavy boundary.

Cg—45 to 60 inches; dark grayish brown (2.5Y 4/2) fine sand; few coarse distinct olive brown (2.5Y 4/4) mottles; single grain; loose; mildly alkaline.

The thickness of the solum ranges from 24 to 40 inches. Reaction ranges from medium acid to mildly alkaline in the solum and from neutral to moderately alkaline in the substratum.

The A horizon has value of 2 or 3 and chroma of 0 to 2. It is dominantly loamy fine sand, but the range includes loamy sand. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is fine sand, sand, loamy sand, or loamy fine sand. In some pedons it has thin lenses of sandy loam. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 4. It is sand, fine sand, or loamy sand. It has a pebble content of 0 to 3 percent.

Guelph Series

The Guelph series consists of well drained or moderately well drained, moderately permeable soils on moraines and till plains. These soils formed in loamy glacial till. Slope ranges from 0 to 18 percent.

Guelph soils are similar to Marlette soils and are commonly adjacent to Boyer, Londo, Tappan, and Wixom soils. Marlette soils have a solum that is thicker than that of the Guelph soils. Boyer soils are coarser textured than the Guelph soils. They are in positions on the landscape similar to those of the Guelph soils. Londo soils are somewhat poorly drained. Tappan soils are poorly drained. Wixom soils are somewhat poorly drained and are coarser textured in the upper part than the Guelph soils. Londo, Tappan, and Wixom soils are in the lower positions on the landscape.

Typical pedon of Guelph loam, in an area of Guelph-Londo loams, 0 to 6 percent slopes, 300 feet south and 1,120 feet east of the northwest corner of sec. 29, T. 14 N., R. 11 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; mildly alkaline; abrupt smooth boundary.

B/E—8 to 12 inches; dark brown (7.5YR 4/4) loam (B); weak medium subangular blocky structure; firm; brown (10YR 5/3) coatings of loam (E), more than 2 millimeters thick, on vertical faces of peds; weak fine and medium granular structure; friable; thin dark brown (7.5YR 3/4) clay films on faces of most peds; mildly alkaline; clear irregular boundary.

Bt—12 to 23 inches; dark brown (7.5YR 4/4) loam; weak medium subangular blocky structure; firm; dark brown (7.5YR 3/4) clay films on faces of most peds; mildly alkaline; abrupt wavy boundary.

C—23 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; strong effervescence; moderately alkaline.

The solum ranges from 12 to 25 inches in thickness. It is slightly acid to mildly alkaline. The content of pebbles ranges from 3 to 10 percent in the solum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loam, but the range includes sandy loam. Some pedons have an E horizon, which is 1 to 3 inches thick. The E horizon and the E part of B/E horizon have value of 5 or 6 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, loam, or silty clay loam. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. It is loam or clay loam. The content of pebbles and cobbles in this horizon is 2 to 5 percent.

Houghton Series

The Houghton series consists of very poorly drained soils in bogs on outwash plains and moraines. These soils formed in organic deposits 51 or more inches thick. Permeability ranges from moderately slow to moderately rapid. Slope is 0 to 2 percent.

Houghton soils are similar to Adrian, Edwards, and Palms soils and are commonly adjacent to those soils and to Granby, Marlette, and Wolcott soils. Adrian soils formed in organic material 16 to 50 inches deep over sandy deposits. Edwards soils formed in organic material 16 to 50 inches deep over marl. Palms soils formed in organic material 16 to 50 inches deep over loamy deposits. Granby soils are sandy throughout, and Wolcott soils are loamy throughout. These two soils are in landscape positions similar to those of the Houghton soils. Marlette soils are well drained, are loamy throughout, and are in the higher positions on the landscape.

Typical pedon of Houghton muck, 396 feet east and 100 feet north of the southwest corner of sec. 34, T. 10 N., R. 7 E.

Oa1—0 to 16 inches; black (N 2/0), broken face, rubbed, and pressed, sapric material; about 8 percent fiber before rubbing and 4 percent after; herbaceous fibers; moderate medium granular structure; very friable; about 5 percent mineral material; many fine roots; neutral; abrupt wavy boundary.

Oa2—16 to 32 inches; black (N 2/0), broken face, rubbed, and pressed, sapric material; about 10 percent fiber before rubbing and 5 percent after; woody fibers; weak medium subangular blocky structure; very friable; about 5 percent mineral material; few fine roots; neutral; abrupt wavy boundary.

Oa3—32 to 50 inches; black (N 2/0), broken face, rubbed, and pressed, sapric material; about 15 percent fiber before rubbing and 7 percent after; herbaceous fibers; weak medium subangular blocky structure; very friable; about 7 percent mineral material; slightly acid; abrupt wavy boundary.

Oa4—50 to 60 inches; black (N 2/0), broken face, rubbed, and pressed, sapric material; about 10 percent fiber before rubbing and 4 percent after; herbaceous fibers; weak medium subangular blocky structure; very friable; about 10 percent mineral material; neutral.

The organic material is 51 or more inches thick. It is primarily herbaceous, but in many pedons it has woody fragments throughout. It ranges from medium acid to mildly alkaline.

The surface tier has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. It is dominantly sapric material, but the range includes hemic material. The subsurface bottom tiers have hue of 10YR, 7.5YR, or 5YR or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 3. They are dominantly sapric material.

Landes Series

The Landes series consists of moderately well drained, rapidly permeable soils on flood plains. These soils formed in loamy and sandy alluvial deposits. Slope ranges from 0 to 3 percent.

Landes soils are commonly adjacent to Chelsea, Cohoctah, Pipestone, Wasepi, and Wixom soils. Chelsea soils are somewhat excessively drained and are in the higher positions on the landscape. They are coarser textured than the Landes soils. Cohoctah soils are very poorly drained and are in the lower positions on the flood plains. Pipestone soils are somewhat poorly drained and are coarser textured than the Landes soils. Wasepi and Wixom soils are somewhat poorly drained. Pipestone, Wasepi, and Wixom soils are in the slightly higher positions on the landscape.

Typical pedon of Landes fine sandy loam, 0 to 3 percent slopes, 400 feet south and 1,750 feet east of the northwest corner of sec. 35, T. 12 N., R. 8 E.

A1—0 to 3 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 4/3) dry; moderate fine and medium granular structure; very friable; neutral; clear wavy boundary.

A2—3 to 12 inches; dark brown (10YR 3/3) fine sandy loam; moderate coarse subangular blocky structure parting to moderate fine and medium subangular blocky; friable; neutral; abrupt wavy boundary.

Bw1—12 to 20 inches; dark yellowish brown (10YR 3/4) loam; few medium faint dark brown (10YR 3/3) organic stains; weak medium angular blocky structure; friable; neutral; clear wavy boundary.

Bw2—20 to 28 inches; dark yellowish brown (10YR 3/4) loam; few fine faint dark brown (10YR 3/3) organic stains and yellowish brown (10YR 5/4) mottles;

weak medium angular blocky structure; friable; neutral; clear wavy boundary.

B/C—28 to 38 inches; dark yellowish brown (10YR 3/4) fine sandy loam (B) and light olive brown (2.5Y 5/4) fine sandy loam (C); common medium distinct very dark gray (10YR 3/1) and few medium distinct yellowish brown (10YR 5/6) mottles; massive; very friable; neutral; abrupt wavy boundary.

C1—38 to 52 inches; light olive brown (2.5Y 5/4) fine sandy loam; common medium prominent very dark gray (10YR 3/1) and few medium distinct yellowish brown (10YR 5/6) mottles; massive; very friable; neutral; abrupt wavy boundary.

C2—52 to 60 inches; dark yellowish brown (10YR 4/4) loamy fine sand; few fine faint yellowish brown (10YR 5/6) and distinct very dark gray (10YR 3/1) mottles; massive; very friable; neutral.

The solum ranges from 25 to 40 inches in thickness. It is slightly acid or neutral.

The A horizon has value and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loam and sandy loam. The B horizon has value and chroma of 3 or 4. It is sandy loam, fine sandy loam, or loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 5. It is very fine sandy loam, fine sandy loam, sandy loam, or loamy fine sand. Organic-enriched layers and thin layers of loamy sand, silt loam, and loam are in some pedons.

Latty Series

The Latty series consists of very poorly drained soils on lake plains. These soils formed in clayey and silty lacustrine sediments. Permeability is slow in the upper part of the pedon and very slow in the lower part. Slope is 0 to 2 percent.

Latty soils are commonly adjacent to Fulton, Rapson, and Wixom soils. The adjacent soils are in the higher positions on the landscape. Fulton soils are somewhat poorly drained. Rapson and Wixom soils have sandy material over loamy material.

Typical pedon of Latty silty clay loam, 140 feet south and 1,670 feet east of the northwest corner of sec. 35, T. 11 N., R. 11 E.

Ap—0 to 10 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; weak medium angular blocky structure; firm; slightly acid; abrupt smooth boundary.

Bg1—10 to 15 inches; grayish brown (10YR 5/2) silty clay; few medium prominent dark grayish brown (2.5Y 4/2) and many medium prominent dark yellowish brown (10YR 4/6) mottles; weak coarse prismatic structure parting to weak medium angular blocky; very firm; neutral; abrupt wavy boundary.

Bg2—15 to 30 inches; gray (10YR 5/1) silty clay; many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to weak medium angular blocky; very firm; neutral; abrupt wavy boundary.

Cg1—30 to 36 inches; grayish brown (2.5Y 5/2) silty clay loam; many coarse prominent dark yellowish brown (10YR 4/6) mottles; massive; very firm; slight effervescence; neutral; abrupt wavy boundary.

Cg2—36 to 54 inches; grayish brown (2.5Y 5/2) silty clay loam; many coarse prominent yellowish brown (10YR 5/6) mottles; massive; very firm; slight effervescence; neutral; abrupt wavy boundary.

Cg3—54 to 60 inches; gray (5Y 5/1) laminated silty clay loam and silty clay; many coarse prominent yellowish brown (10YR 5/6) mottles; massive; very firm; slight effervescence; neutral.

The solum is 30 to 43 inches thick. The A horizon has hue of 10YR or 2.5Y and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes silty clay. This horizon is slightly acid or neutral. The B horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is silty clay or silty clay loam. It is slightly acid or neutral. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 or 2. It is silty clay to silt loam. It is neutral or mildly alkaline.

Lenawee Variant

The Lenawee Variant consists of very poorly drained, slowly permeable or moderately slowly permeable soils on lake plains and in lakebeds. These soils formed in loamy, silty, and clayey lacustrine material. Slope is 0 to 2 percent.

Lenawee Variant soils are commonly adjacent to Olentangy, Tappan, and Thomas soils. The adjacent soils have less calcium than the Lenawee Variant. They are in the slightly higher positions on the landscape. Olentangy soils have layers of coprogenous earth and are very poorly drained. Thomas soils also are very poorly drained.

Typical pedon of Lenawee Variant silty clay loam, in an area of Tappan-Lenawee Variant complex, 1,084 feet south and 372 feet east of northwest corner of sec. 21, T. 13 N., R. 7 E.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 6/1) dry; weak fine granular structure; friable; few fine white (10YR 8/1) shell fragments; about 62 percent calcium carbonate; violent effervescence; moderately alkaline; abrupt smooth boundary.

Cg1—10 to 16 inches; light gray (10YR 6/1) clay loam; weak fine angular blocky structure; friable; many fine white (10YR 8/1) shell fragments; violent effervescence; about 64 percent calcium carbonate; moderately alkaline; abrupt wavy boundary.

Cg2—16 to 21 inches; grayish brown (10YR 5/2) silty clay loam; few fine faint yellowish brown (10YR 5/4) mottles; very weak fine angular blocky structure; friable; few very fine pores; some thin dark grayish brown (10YR 4/2) coatings in vertical cracks; about 35 percent calcium carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cg3—21 to 25 inches; dark grayish brown (10YR 4/2) silty clay; massive; firm; few thin prominent light gray (10YR 7/2) lime coatings; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cg4—25 to 52 inches; dark grayish brown (10YR 4/2) silty clay; many medium prominent dark yellowish brown (10YR 3/6) mottles; massive; firm; many fine prominent light gray (10YR 7/2) lime streaks; about 35 percent calcium carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

2C—52 to 60 inches; brown (10YR 5/3) loam; few fine faint dark brown (10YR 4/3) mottles; massive; firm; about 2 percent pebbles; about 36 percent calcium carbonate; violent effervescence; moderately alkaline.

The Ap horizon is 6 to 11 inches thick. The upper part of the pedon has few to many shell fragments. The solum is mildly alkaline or moderately alkaline. The content of pebbles is 0 to 2 percent in the upper part of the pedon and 2 to 9 percent in the lower part.

The A horizon has value of 3 or 4 and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes clay loam and silt loam. The Cg1 horizon has value of 5 to 7 and chroma of 1 or 2. It is silty clay loam, clay loam, or silt loam. The lower part of the C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 3. It is stratified silty clay, silty clay loam, or silt loam. The 2C horizon has value of 4 or 5 and chroma of 2 to 4. It is loam or clay loam.

Londo Series

The Londo series consists of somewhat poorly drained soils on lake plains, till plains, and moraines. These soils formed in loamy material. Permeability is moderate or or moderately slow. Slope ranges from 0 to 3 percent.

Londo soils are commonly adjacent to Avoca, Guelph, and Tappan soils. Avoca soils are coarser textured in the upper part than the Londo soils. They are in landscape positions similar to those of the Londo soils. Guelph soils are well drained and moderately well drained and are in the higher positions on the landscape. Tappan soils are poorly drained, are calcareous, and have a surface layer that is thicker and darker than that of the Londo soils. They are in the lower positions on the landscape.

Typical pedon of Londo loam, 0 to 3 percent slopes, 500 feet east and 470 feet south of the northwest corner of sec. 35, T. 11 N., R. 7 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

B/E—10 to 14 inches; dark yellowish brown (10YR 4/4) loam (Bt); few fine faint dark grayish brown (10YR 4/2) mottles; weak fine and medium subangular blocky structure; friable; thin discontinuous dark grayish brown (10YR 4/2) clay films; 15 percent or more grayish brown (10YR 5/2) thick coatings of sandy loam (E) on faces of peds and lining vertical cracks and tubular pores; weak fine subangular blocky structure; very friable; neutral; abrupt irregular boundary.

Bt—14 to 20 inches; dark yellowish brown (10YR 4/4) clay loam; common fine faint very dark grayish brown (10YR 3/2) mottles; weak fine angular blocky structure; firm; thin dark grayish brown (10YR 4/2) clay films on faces of most peds; neutral; clear irregular boundary.

C1—20 to 40 inches; dark yellowish brown (10YR 4/4) loam; many medium faint dark grayish brown (10YR 4/2) mottles; weak coarse angular blocky structure; friable; few light gray (10YR 7/2) calcium carbonate streaks and nodules; mildly alkaline; slight effervescence; clear irregular boundary.

C2—40 to 60 inches; brown (10YR 5/3) loam; few medium prominent gray (N 6/0) mottles; massive; friable; few light gray (10YR 7/2) calcium carbonate streaks; moderately alkaline; strong effervescence.

The solum ranges from 12 to 25 inches in thickness. It is slightly acid to mildly alkaline. The content of pebbles and cobbles ranges from 0 to 10 percent throughout the pedon.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam. The E part of the B/E horizon has value of 5 to 6 and chroma of 2 or 3. It is loam or sandy loam. The Bt part of the B/E horizon and the Bt horizon have hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. They are loam or clay loam. The C horizon also is loam or clay loam. It has chroma of 3 or 4.

Marlette Series

The Marlette series consists of well drained, moderately slowly permeable soils on moraines. These soils formed in loamy material. Slope ranges from 2 to 35 percent.

Marlette soils are similar to Guelph soils and are commonly adjacent to Capac, Metea, and Spinks soils. Guelph soils have a solum that is thinner than that of the Marlette soils. Capac soils are somewhat poorly drained and are in the lower positions on the landscape. Metea soils are coarser textured in the upper part than the Marlette soils. Spinks soils are coarser textured throughout than the Marlette soils. Metea and Spinks soils are in landscape positions similar to those of the Marlette soils.

Typical pedon of Marlette sandy loam, in an area of Marlette-Capac complex, 0 to 6 percent slopes, 50 feet north and 1,213 feet west of the southeast corner of sec. 22, T. 10 N., R. 8 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable; neutral; abrupt smooth boundary.

B/E—8 to 20 inches; yellowish brown (10YR 5/4) loam (Bt); grayish brown (10YR 5/2) coatings of sandy loam (E), 2 or more millimeters thick, on faces of peds; weak fine and medium angular blocky structure; friable; thin discontinuous brown (10YR 4/3) clay films; neutral; abrupt irregular boundary.

Bt1—20 to 28 inches; dark brown (10YR 4/3) clay loam; moderate medium angular blocky structure; firm; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; neutral; abrupt irregular boundary.

Bt2—28 to 31 inches; brown (10YR 5/3) loam; weak medium and coarse angular blocky structure; friable; dark brown (10YR 3/3) coatings; mildly alkaline; abrupt irregular boundary.

C—31 to 60 inches; yellowish brown (10YR 5/4) loam; massive; firm; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 25 to 40 inches and corresponds to the depth to free carbonates. Reaction is neutral to mildly alkaline in the solum. The content of pebbles ranges from 2 to 10 percent throughout the pedon.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly sandy loam, but the range includes fine sandy loam and loam. Some pedons have an E horizon. The E horizon and the E part of the B/E horizon have value of 5 or 6 and chroma of 2 or 3. They are sandy loam or loam. The B horizon and the B part of the B/E horizon have value of 3 to 5 and chroma of 3 or 4. They are loam or clay loam. The C horizon also is loam or clay loam. It has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4.

Metamora Series

The Metamora series consists of somewhat poorly drained soils on till plains and low moraines. These soils formed in loamy outwash deposits and in the underlying loamy glacial till. Permeability is moderately rapid in the upper part of the pedon and moderately slow in the lower part. Slope ranges from 0 to 4 percent.

Metamora soils are similar to Capac and Shebeon soils and are commonly adjacent to Belleville, Corunna, Londo, and Wixom soils. Capac, Londo, and Shebeon soils are finer textured in the upper part than the Metamora soils. Shebeon soils have a substratum of dense loamy till. Belleville soils are poorly drained and are coarser textured in the upper part than the Metamora soils. Corunna soils are poorly drained. Belleville and Corunna soils are in the lower positions on the landscape. Wixom soils are coarser textured in the upper part than the Metamora soils. Wixom and Londo soils are in landscape positions similar to those of the Metamora soils.

Typical pedon of Metamora sandy loam, 0 to 4 percent slopes, 1,230 feet east and 750 feet north of the center of sec. 10, T. 13 N., R. 9 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.

E—10 to 20 inches; yellowish brown (10YR 5/4) sandy loam; common fine faint brownish yellow (10YR 6/6) mottles; weak fine subangular blocky structure; friable; neutral; abrupt wavy boundary.

2Bt—20 to 28 inches; dark yellowish brown (10YR 4/6) loam; common medium distinct dark grayish brown (10YR 4/2) and dark brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to moderate medium angular blocky; friable; common thin grayish brown (10YR 5/2) clay films on faces of peds; neutral; abrupt irregular boundary.

2C—28 to 60 inches; yellowish brown (10YR 5/4) loam; common medium distinct gray (10YR 6/1) and light brown (7.5YR 6/4) mottles; massive; firm; mildly alkaline.

The solum ranges from 18 to 30 inches in thickness. It is slightly acid or neutral. The content of pebbles ranges from 0 to 10 percent in the solum.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly sandy loam, but the range includes loamy sand and fine sandy loam. The E horizon has value of 5 or 6 and chroma of 2 to 4. It is sandy loam, fine sandy loam, or loamy fine sand. The 2Bt horizon has value of 4 to 6 and chroma of 2 to 6. It is loam, clay loam, or silty clay loam. The 2C horizon also is loam, clay loam, or silty clay loam. It has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4.

Metea Series

The Metea series consists of well drained soils on till plains and moraines. These soils formed in sandy and loamy deposits. Permeability is rapid in the upper part of the pedon and moderate in the lower part. Slope ranges from 1 to 6 percent.

Metea soils are similar to Boyer and Perrin soils and are commonly adjacent to Chelsea, Marlette, and Wixom soils. Except for Wixom soils, all of these soils are in landscape positions similar to those of the Metea soils. Boyer and Perrin soils are finer textured in the upper part than the Metea soils and coarser textured in the lower part. Perrin soils are moderately well drained. Chelsea soils are coarser textured in the lower part than the Metea soils, and Marlette soils are finer textured in the upper part. Wixom soils are somewhat poorly drained and are in the lower landscape positions.

Typical pedon of Metea loamy fine sand, 1 to 6 percent slopes, 788 feet south and 145 feet east of the northwest corner of sec. 25, T. 10 N., R. 7 E.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) loamy fine sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

E—12 to 32 inches; dark yellowish brown (10YR 4/4) loamy fine sand; very weak fine subangular blocky structure; very friable; slightly acid; abrupt irregular boundary.

Bt1—32 to 37 inches; yellowish brown (10YR 5/4) fine sandy loam; very weak fine and medium subangular blocky structure; friable; slightly acid; abrupt irregular boundary.

2Bt2—37 to 43 inches; dark yellowish brown (10YR 4/4) sandy clay loam; few thin dark brown (10YR 4/3) clay films on faces of peds; weak fine and medium subangular blocky structure; friable; thin brown (10YR 5/3) coatings of fine sandy loam in the upper 2 inches; neutral; abrupt irregular boundary.

2C1—43 to 57 inches; brown (10YR 5/3) loam; common medium faint dark yellowish brown (10YR 4/6) mottles; weak coarse subangular blocky structure; firm; strong effervescence; moderately alkaline; abrupt irregular boundary.

2C2—57 to 60 inches; brown (10YR 5/3) loam; few medium faint dark yellowish brown (10YR 4/4) mottles; massive; firm; common thin gray (10YR 6/1) lime coatings; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 36 to 50 inches and the depth to the 2Bt horizon from 20 to 39 inches. The sandy part of the solum is medium acid to neutral. The content of pebbles ranges from 3 to 10 percent in the solum.

The A1 or Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes loamy sand, sand, and fine sand. Some pedons have an E horizon. This horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is loamy fine sand, loamy sand, fine sand, or sand. The Bt1 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is fine sandy loam or sandy loam. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is sandy clay loam or clay loam. The 2C horizon has chroma of 3 to 6. It is loam, clay loam, or silt loam. It is mildly alkaline or moderately alkaline.

Olentangy Series

The Olentangy series consists of very poorly drained soils on lake plains. These soils formed in organic and silty sediments over lacustrine material or glacial till. Permeability is moderate in the coprogenous earth and slow in the lower part of the pedon. Slope is 0 to 2 percent.

Olentangy soils are similar to Thomas soils and are commonly adjacent to Tappan soils. Thomas soils are calcareous and have organic material less than 16 inches deep over loamy material. Tappan soils are poorly drained and are calcareous loam in the upper part. They are in landscape positions similar to those of the Olentangy soils or are in slightly higher areas.

Typical pedon of Olentangy mucky silt loam, 1,940 feet west and 550 feet south of the northeast corner of sec. 30, T. 13 N., R. 7 E.

Ap—0 to 10 inches; black (10YR 2/1), broken face, mucky silt loam (coprogenous earth), very dark brown (10YR 2/2) rubbed; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

C1—10 to 22 inches; dark brown (7.5YR 3/2) mucky silt loam (coprogenous earth) few thin layers of black (N 2/0) organic material; moderate fine and medium platy structure; firm; neutral; abrupt smooth boundary.

C2—22 to 25 inches; dark gray (5Y 4/1) silt loam; common medium distinct light gray (5Y 6/1) and few fine prominent olive brown (2.5Y 4/4) mottles; weak medium angular blocky structure; very firm; neutral; abrupt smooth boundary.

C3—25 to 33 inches; grayish brown (2.5Y 5/2) silt loam; common fine prominent strong brown (7.5YR 5/6) mottles; massive; very firm; strong effervescence; mildly alkaline; abrupt irregular boundary.

C4—33 to 45 inches; light olive brown (2.5Y 5/4) silt loam; common fine distinct olive (5Y 5/3) and few fine prominent strong brown (7.5YR 5/6) mottles; massive; very firm; strong effervescence; mildly alkaline; abrupt irregular boundary.

C5—45 to 60 inches; olive (5Y 5/3) silt loam; common fine distinct light olive brown (2.5Y 5/4) and few fine prominent strong brown (7.5YR 5/6) mottles; massive; firm; violent effervescence; moderately alkaline.

The thickness of the coprogenous earth ranges from 20 to 24 inches. Reaction is slightly acid to mildly alkaline in the coprogenous earth and mildly alkaline or moderately alkaline in the lower part of the C horizon.

The Ap horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly mucky silt loam, but range includes muck. The C1 horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 to 4 and chroma of 0 to 2. It is silt loam or mucky silt loam. The lower part of the C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 4. It is silt loam, loam, or silty clay loam.

Ottokee Series

The Ottokee series consists of moderately well drained, rapidly permeable soils on old beach ridges and outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 6 percent.

These soils have a mollic surface layer, which is not definitive for the Ottokee series. This difference, however, does not alter the usefulness or behavior of the soils.

Ottokee soils are similar to Chelsea and Thetford soils and are commonly adjacent to Chelsea, Spinks, and Thetford soils. Chelsea soils are somewhat excessively drained. Spinks soils are well drained, and Thetford soils are somewhat poorly drained. Spinks and Thetford soils have lamellae that total more than 6 inches thick.

Typical pedon of Ottokee loamy fine sand, 0 to 6 percent slopes, 2,475 feet north and 990 feet east of the southwest corner of sec. 12, T. 10 N., R. 7 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark brown (10YR 4/3) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

A—8 to 16 inches; dark brown (7.5YR 3/2) loamy fine sand, brown (10YR 5/3) dry; weak fine granular structure; very friable; neutral; abrupt wavy boundary.

E&Bt1—16 to 24 inches; yellowish brown (10YR 5/4) fine sand (E); single grain; loose; dark yellowish brown (10YR 4/4) loamy fine sand lamellae (B), 1/8 to 1/4 inch thick, 1 inch total thickness; few fine distinct yellowish brown (10YR 5/8) mottles; weak thin and medium platy structure; very friable; neutral; abrupt wavy boundary.

E&Bt2—24 to 40 inches; yellowish brown (10YR 5/4) fine sand (E); few medium faint grayish brown (10YR 5/2) mottles; single grain; loose; dark yellowish brown (10YR 4/4) loamy fine sand lamellae (B), 1/8 to 1/4 inch thick, 2 inches total thickness; weak thin and medium platy structure; friable; neutral; abrupt wavy boundary.

E&Bt3—40 to 60 inches; yellowish brown (10YR 5/4) fine sand (E); few fine faint brown (10YR 5/3) mottles; single grain; loose; dark brown (7.5YR 4/4) loamy fine sand lamellae (B), 1/8 to 1/4 inch thick, 2 inches total thickness; weak medium and thick platy structure; friable; neutral.

The solum ranges from 40 to more than 60 inches in thickness. It is medium acid to neutral. The content of pebbles ranges from 0 to 5 percent in the solum.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes fine sand. The E part of the E&B horizon has chroma of 3 or 4. It is fine sand, sand, or loamy fine sand. The B part has hue of 10YR or 7.5YR and value of 3 or 4. It is loamy fine sand or sandy loam. Some pedons have a C horizon. This horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 to 3. It is fine sand or sand. It ranges from neutral to moderately alkaline.

Palms Series

The Palms series consists of very poorly drained soils in bogs on till plains, lake plains, outwash plains, and moraines. These soils formed in well decomposed organic material 16 to 50 inches deep over mineral material. Permeability is moderately slow to moderately rapid in the organic material and moderate or moderately slow in the mineral material. Slope is less than 1 percent.

Palms soils are similar to Adrian and Houghton soils and are commonly adjacent to Adrian, Edwards, and Houghton soils. Adrian soils formed in organic deposits 16 to 50 inches deep over sandy material. Edwards soils formed in organic deposits 16 to 50 inches deep over marl. They are in landscape positions similar to those of the Palms soils. Houghton soils formed in organic deposits 51 or more inches thick.

Typical pedon of Palms muck, 1,576 feet west and 125 feet north of the center of sec. 15, T. 11 N., R. 11 E.

Op—0 to 11 inches; black (N 2/0), broken face and rubbed, sapric material; about 3 percent fiber, less than 3 percent rubbed; moderate fine granular structure; friable; about 5 percent mineral material; medium acid; abrupt smooth boundary.

Oa1—11 to 19 inches; black (N 2/0), broken face and rubbed, sapric material; about 5 percent fiber, less than 5 percent rubbed; herbaceous fibers; massive; friable; about 3 percent mineral material; slightly acid; abrupt wavy boundary.

Oa2—19 to 25 inches; very dark brown (10YR 2/2), broken face and rubbed, sapric material; common medium prominent reddish brown (5YR 4/3) mottles; massive; friable; about 40 percent mineral material; slightly acid; abrupt wavy boundary.

Cg1—25 to 31 inches; dark grayish brown (2.5Y 4/2) loamy sand; common medium faint grayish brown (10YR 5/2) mottles; massive; friable; neutral; abrupt wavy boundary.

Cg2—31 to 52 inches; grayish brown (2.5Y 5/2) silt loam; common coarse distinct olive brown (2.5Y 4/4) mottles; massive; firm; neutral; abrupt wavy boundary.

Cg3—52 to 55 inches; dark gray (10YR 4/1) sand; common medium faint dark grayish brown (10YR

4/2) mottles; single grain; loose; neutral; abrupt wavy boundary.

Cg4—55 to 60 inches; gray (10YR 5/1) silt loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; neutral.

The solum ranges from 16 to 50 inches in thickness. It is medium acid to mildly alkaline. The content of woody fragments ranges from 0 to 15 percent in the organic material.

The surface tier has hue of 5YR, 7.5YR, or 10YR or is neutral in hue. It has chroma of 0 to 2. The subsurface tier has hue of 5YR, 7.5YR, or 10YR or is neutral in hue. It has value of 2 to 4 and chroma of 0 to 3. The Cg horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 or 2. It is dominantly loam, silt loam, clay loam, silty clay loam, or sandy loam, but it commonly has thin strata of loamy sand or sand.

Pella Series

The Pella series consists of poorly drained, moderately permeable soils on lake plains. The soils formed in silty lacustrine sediments. Slope is 0 to 2 percent.

Pella soils are similar to Bach, Tappan, and Wolcott soils and are commonly adjacent to Sanilac and Wixom soils. Bach and Sanilac soils have less clay in the solum than the Pella soils, and Tappan and Wolcott soils have less silt. Sanilac and Wixom soils are somewhat poorly drained and are in the higher positions on the landscape. Wixom soils are coarser textured in the upper part than the Pella soils.

Typical pedon of Pella silt loam, 3,200 feet south and 175 feet west of the northeast corner of sec. 30, T. 11 N., R. 7 E.

Ap—0 to 12 inches; very dark grayish brown (2.5Y 3/2) silt loam, grayish brown (2.5Y 5/2) dry; weak coarse granular structure; friable; neutral; abrupt smooth boundary.

Bg1—12 to 20 inches; dark grayish brown (2.5Y 4/2) silt loam; common fine distinct dark yellowish brown (10YR 4/6) mottles; weak fine angular blocky structure; friable; mildly alkaline; abrupt wavy boundary.

Bg2—20 to 32 inches; grayish brown (10YR 5/2) silt loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak fine and medium angular blocky structure; friable; moderately alkaline; abrupt wavy boundary.

C—32 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct dark yellowish brown (10YR 4/6) mottles; massive; friable; some thin very dark grayish brown (10YR 3/2) coatings; violent effervescence; moderately alkaline.

The solum is 32 to 44 inches thick. It is neutral or mildly alkaline.

The Ap horizon has hue of 2.5Y or 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam and loam. The Bg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silt loam or silty clay loam. The C horizon has value of 4 to 6 and chroma of 2 to 4. It is silt loam or silty clay loam and has varves of silt or clay in some pedons.

Perrin Series

The Perrin series consists of moderately well drained soils on old beach ridges and outwash plains. These soils formed in sandy and loamy material. Permeability is moderately rapid in the upper part of the pedon and very rapid in the lower part. Slope ranges from 0 to 4 percent.

Perrin soils are similar to Boyer and Metea soils and are commonly adjacent to Gilford, Tappan, and Wasepi soils. Boyer and Metea soils are well drained. Metea soils are finer textured in the lower part than the Perrin soils. Gilford soils are very poorly drained and are in the lower positions on the landscape. Tappan soils are poorly drained, are finer textured throughout than the Perrin soils, and are in the lower positions on the landscape. Wasepi soils are somewhat poorly drained and are slightly lower on the landscape than the Perrin soils.

Typical pedon of Perrin loamy sand, 0 to 4 percent slopes, 757 feet east of the center of sec. 3, T. 14 N., R. 9 E.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

E—11 to 20 inches; yellowish brown (10YR 5/6) loamy sand; weak fine subangular blocky structure; very friable; neutral; clear wavy boundary.

Bt—20 to 32 inches; dark brown (7.5YR 4/4) fine sandy loam; few fine distinct brown (10YR 5/3) and common medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; neutral; abrupt wavy boundary.

2C1—32 to 41 inches; pale brown (10YR 6/3) sand; single grain; loose; about 10 percent pebbles; mildly alkaline; abrupt smooth boundary.

2C2—41 to 60 inches; light yellowish brown (10YR 6/4) very gravelly sand; single grain; loose; about 38 percent pebbles; strong effervescence; mildly alkaline.

The solum ranges from 24 to 40 inches in thickness. It is slightly acid or neutral. The content of pebbles and cobbles ranges from 1 to 25 percent in the solum.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The E horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The Bt horizon has hue of

10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 5. It is fine sandy loam, sandy loam, gravelly sandy loam, or gravelly sandy clay loam. The 2C horizon has value of 5 or 6 and chroma of 2 to 4. It is sand, very gravelly sand, or stratified sand and gravel.

Pipestone Series

The Pipestone series consists of somewhat poorly drained soils on outwash plains, lake plains, till plains, and beach ridges. These soils formed in sandy material. Permeability generally is rapid throughout the pedon. In the loamy substratum phase, however, it is rapid in the upper part of the pedon and slow or moderately slow in the lower part. Slope ranges from 0 to 4 percent.

Pipestone soils are commonly adjacent to Chelsea, Covert, Granby, and Thetford soils. Chelsea soils are somewhat excessively drained and have lamellae in the subsoil. They are in the higher positions on the landscape. Covert soils are moderately well drained and are slightly higher on the landscape than the Pipestone soils. Granby soils are poorly drained and are in the lower positions on the landscape. Thetford soils do not have a spodic horizon and have an argillic horizon of lamellae. They are in positions on the landscape similar to those of the Pipestone soils.

Typical pedon of Pipestone fine sand, 0 to 4 percent slopes, 3,825 feet north and 150 feet east of the southwest corner of sec. 33, T. 11 N., R. 7 E.

Ap—0 to 6 inches; black (N 2/0) fine sand, very dark gray (N 3/0) dry; weak fine granular structure; friable; strongly acid; abrupt smooth boundary.

E—6 to 10 inches; grayish brown (10YR 5/2) fine sand; common coarse faint dark grayish brown (10YR 4/2) mottles; weak fine granular structure; very friable; medium acid; abrupt irregular boundary.

Bhs1—10 to 11 inches; very dark grayish brown (10YR 3/2) fine sand; common medium faint dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure; very friable; medium acid; abrupt irregular boundary.

Bhs2—11 to 18 inches; dark brown (10YR 3/3) loamy sand; common medium distinct dark brown (7.5YR 3/2) mottles; weak fine subangular blocky structure; very friable; slightly acid; abrupt irregular boundary.

Bs—18 to 45 inches; dark yellowish brown (10YR 4/6) fine sand; common medium distinct strong brown (7.5YR 5/6) mottles; single grain; loose; slightly acid; abrupt wavy boundary.

C—45 to 60 inches; yellowish brown (10YR 5/4) sand; few fine faint yellowish brown (10YR 5/6) mottles; single grain; loose; neutral.

The solum ranges from 20 to 45 inches in thickness. It is strongly acid to neutral. The content of pebbles ranges from 0 to 10 percent in the solum.

The A or Ap horizon has value of 2 to 4 and chroma of 0 to 2. It is dominantly fine sand, but the range includes loamy fine sand. The E horizon has value of 5 to 7 and chroma of 1 to 3. Some pedons do not have an E horizon. The B horizon has hue of 10YR, 7.5YR, or 5YR, value of 2 to 5, and chroma of 2 to 6. It is fine sand, loamy fine sand, or sand. The content of ortstein in this horizon is 0 to 20 percent. The C horizon has value of 5 or 6 and chroma of 2 to 6. It is fine sand or sand. It is slightly acid or neutral. It has a pebble content of 0 to 10 percent. Some pedons have loam or clay loam below a depth of 40 inches.

Rapson Series

The Rapson series consists of somewhat poorly drained soils on outwash plains and lake plains. These soils formed in sandy material over stratified silty and sandy material. Permeability is rapid in the upper part of the pedon and moderate in the lower part. Slope ranges from 0 to 3 percent.

Rapson soils are similar to Avoca soils and are commonly adjacent to Granby, Ottokee, and Sanilac soils. Avoca soils are finer textured in the lower part than the Rapson soils, and Granby and Ottokee soils are coarser textured. Granby soils are poorly drained and are in the lower positions on the landscape. Ottokee soils are moderately well drained and are in the slightly higher positions on the landscape. Sanilac soils are finer textured in the upper part than the Rapson soils. They are in landscape positions similar to those of the Rapson soils.

Typical pedon of Rapson loamy fine sand, 0 to 3 percent slopes, 330 feet east and 130 feet north of the center of sec. 25, T. 11 N., R. 7 E.

Ap—0 to 12 inches; very dark gray (10YR 3/1) loamy fine sand, dark gray (10YR 4/1) dry; very weak fine granular structure; very friable; mildly alkaline; abrupt smooth boundary.

E—12 to 15 inches; grayish brown (10YR 5/2) loamy fine sand; very weak subangular blocky structure; very friable; neutral; abrupt broken boundary.

Bhs—15 to 20 inches; dark brown (7.5YR 3/2) loamy fine sand; common medium distinct yellowish brown (10YR 5/6) mottles; very weak fine subangular blocky structure; very friable; few hard chunks of ortstein; neutral; abrupt irregular boundary.

Bs1—20 to 23 inches; yellowish brown (10YR 5/4) loamy fine sand; common medium distinct brown (7.5YR 4/4) mottles; very weak fine and medium subangular blocky structure; very friable; neutral; abrupt wavy boundary.

Bs2—23 to 25 inches; brown (7.5YR 4/4) loamy fine sand; weak medium subangular blocky structure; very friable; neutral; abrupt wavy boundary.

BC—25 to 38 inches; dark yellowish brown (10YR 4/4) loamy fine sand; weak medium and coarse subangular blocky structure; friable; neutral; abrupt wavy boundary.

2C1—38 to 50 inches; brown (10YR 5/3) stratified silt loam and loamy very fine sand; few fine distinct dark brown (7.5YR 4/4) mottles; massive; friable; violent effervescence; moderately alkaline; abrupt wavy boundary.

2C2—50 to 60 inches; grayish brown (10YR 5/2); stratified silt loam and loamy very fine sand; few fine distinct light yellowish brown (10YR 6/4) mottles; massive; friable; violent effervescence; moderately alkaline.

The solum ranges from 20 to 38 inches in thickness. It is medium acid to mildly alkaline.

The Ap horizon has value of 2 to 4 and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes fine sand. The E horizon has value of 5 or 6 and chroma of 2 or 3. It is loamy fine sand or fine sand. The B horizon has hue of 7.5YR or 10YR, value of 2 to 5, and chroma of 2 to 4. It is loamy fine sand or fine sand. The 2C horizon has value of 4 to 6 and chroma of 1 to 4. It is stratified silt loam, silt, loamy very fine sand, and fine sand.

Sanilac Series

The Sanilac series consists of somewhat poorly drained soils on lake plains and deltas. These soils formed in calcareous, silty lacustrine sediments. Permeability is moderate or moderately slow. Slope ranges from 0 to 3 percent.

Sanilac soils are commonly adjacent to Bach, Londo, and Rapson soils. Bach soils are poorly drained and are in the lower positions on the landscape. Londo soils are finer textured throughout than the Sanilac soils, and Rapson soils are coarser textured in the upper part. Londo and Rapson soils are in landscape positions similar to those of the Sanilac soils.

Typical pedon of Sanilac silt loam, 0 to 3 percent slopes, 230 feet west and 1,700 feet south of the northeast corner of sec. 4, T. 14 N., R. 10 E.

Ap—0 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable; many fine and medium roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

Bw1—13 to 21 inches; brown (10YR 5/3) silt loam; grayish brown (10YR 5/2) coatings on faces of peds; few fine faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) mottles; weak fine and medium angular blocky structure parting to very weak thin platy; friable; dark grayish brown (10YR 4/2) silt coatings; few fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

Bw2—21 to 35 inches; yellowish brown (10YR 5/4) silt loam; common fine faint brown (10YR 5/3) mottles; weak thin and medium platy structure; friable; strong effervescence; moderately alkaline; abrupt wavy boundary.

C—35 to 60 inches; brown (10YR 5/3) silt loam; few fine distinct gray (10YR 6/1) mottles; massive; friable; strong effervescence; moderately alkaline.

The solum ranges from 10 to 40 inches in thickness. It is mildly alkaline or moderately alkaline.

The Ap horizon has value of 3 or 4 (6 or more dry) and chroma of 1 or 2. It is dominantly silt loam, but the range includes very fine sandy loam. The Bw horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 4. It is silt loam or very fine sandy loam. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 to 3. It is stratified silt loam, very fine sandy loam, loamy very fine sand, and very fine sand.

Shebeon Series

The Shebeon series consists of somewhat poorly drained soils on lake plains and till plains. These soils formed in loamy glacial till. Permeability is moderate or moderately slow in the upper part of the pedon and very slow in the lower part. Slope is less than 1 percent.

Shebeon soils are similar to Capac, Fulton, and Metamora soils and are commonly adjacent to Avoca, Londo, Sanilac, and Tappan soils. Capac soils have a solum that is thicker than that of the Shebeon soils. Fulton soils have a clayey substratum. Avoca soils are coarser textured in the upper part than the Shebeon soils. Londo and Metamora soils do not have compacted loamy till. Sanilac soils are calcareous and are coarser textured throughout the solum than the Shebeon soils. Avoca, Londo, and Sanilac soils are in landscape positions similar to those of the Shebeon soils. Tappan soils are poorly drained, are calcareous, and are in the lower positions on the landscape.

Typical pedon of Shebeon loam, 0 to 1 percent slopes, 300 feet south and 1,100 feet west of the center of sec. 16, T. 14 N., R. 10 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; about 2 percent fine pebbles; mildly alkaline; abrupt smooth boundary.

Bt—9 to 17 inches; brown (10YR 5/3) clay loam; common medium faint dark grayish brown (10YR 4/2) and few fine faint grayish brown (10YR 5/2) mottles; weak fine and medium angular blocky structure; friable; many distinct dark grayish brown (10YR 4/2) clay films; mildly alkaline; clear wavy boundary.

C1—17 to 48 inches; brown (10YR 5/3) loam; common medium distinct yellowish brown (10YR 5/6) and faint grayish brown (10YR 5/2) mottles; weak medium and thin platy structure; firm in the upper part and very firm below a depth of about 27 inches; few thin gray (10YR 5/1) limy crack fillings and plate coatings; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—48 to 60 inches; brown (10YR 5/3) loam; common medium faint yellowish brown (10YR 5/4) mottles; weak medium platy structure; very firm; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 11 to 26 inches. The depth to the very firm, dense loamy till ranges from 24 to 40 inches. Reaction is neutral or mildly alkaline in the solum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loam, but the range includes sandy loam. Some pedons have a BE horizon. The Bt horizon has value of 4 or 5 and chroma of 2 to 4. It is clay loam or loam. The C horizon also is clay loam or loam. It has value of 5 or 6 and chroma of 3 or 4.

Sloan Series

The Sloan series consists of very poorly drained soils on flood plains. These soils formed in loamy alluvial deposits. Permeability is moderate or moderately slow. Slope is 0 to 2 percent.

Sloan soils are commonly adjacent to Cohoctah and Tappan soils. Cohoctah soils are coarser textured than the Sloan soils. They are in landscape positions similar to those of the Sloan soils. Tappan soils decrease regularly in organic matter content with increasing depth. They are in the slightly higher positions on the landscape.

Typical pedon of Sloan loam, 400 feet east and 450 feet south of the northwest corner of sec. 8, T. 11 N., R. 8 E.

Ap—0 to 14 inches; very dark grayish brown (2.5Y 3/2) loam, grayish brown (2.5Y 5/2) dry; weak medium granular structure; friable; mildly alkaline; abrupt smooth boundary.

Bg1—14 to 18 inches; dark grayish brown (2.5Y 4/2) loam; many fine distinct dark yellowish brown (10YR 3/4) and gray (10YR 5/1) mottles; weak fine subangular blocky structure; friable; mildly alkaline; clear irregular boundary.

Bg2—18 to 26 inches; dark grayish brown (2.5Y 4/2) loam; many fine prominent dark yellowish brown (10YR 4/6) mottles; common fine prominent black (10YR 2/1) organic stains; weak medium and fine subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

Bg3—26 to 30 inches; dark grayish brown (10YR 4/2) loam; many medium prominent grayish brown (10YR 5/2) mottles; many medium prominent very dark brown (10YR 2/2) organic stains; weak fine and medium subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

C1—30 to 50 inches; olive brown (2.5Y 4/4) fine sandy loam; many medium distinct very dark grayish brown and dark grayish brown (2.5Y 3/2, 4/2) mottles; massive; friable; mildly alkaline; abrupt wavy boundary.

C2—50 to 60 inches; olive brown (2.5Y 4/4) fine sandy loam; many medium distinct grayish brown (2.5Y 5/2) and dark yellowish brown (10YR 3/4) mottles and black (10YR 2/1) organic stains; massive; friable; mildly alkaline.

The solum ranges from 20 to 55 inches in thickness. It is slightly acid to mildly alkaline. The depth to free carbonates ranges from 22 to 60 inches. The content of pebbles is 0 to 5 percent in the solum.

The A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly loam, but the range includes silt loam. The B horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 2. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1 to 4. It is stratified silty clay loam, clay loam, loam, silt loam, and fine sandy loam. The content of pebbles in this horizon ranges from 0 to 20 percent. Some thin, organic-enriched layers have value of 2 or 3 and chroma of 0 to 2.

Spinks Series

The Spinks series consists of well drained soils on moraines, outwash plains, and old beach ridges. These soils formed in sandy glacial till or glaciofluvial material. Permeability is moderately rapid. Slope ranges from 0 to 35 percent.

Spinks soils are commonly adjacent to Boyer, Chelsea, and Marlette soils. The adjacent soils are in landscape positions similar to those of the Spinks soils. Boyer soils have a subsoil that is finer textured than that of the Spinks soils and have a gravelly substratum. Chelsea soils are somewhat excessively drained and have fewer and thinner lamellae than the Spinks soils. Marlette soils are finer textured throughout than the Spinks soils.

Typical pedon of Spinks loamy fine sand, 0 to 6 percent slopes, 2,640 feet west and 1,320 feet south of the northeast corner of sec. 33, T. 14 N., R. 10 E.

A—0 to 7 inches; dark brown (10YR 3/3) loamy fine sand, brown (10YR 5/3) dry; weak fine granular structure; very friable; common medium very dark grayish brown (10YR 3/2) organic stains; common fine roots; strongly acid; abrupt wavy boundary.

E—7 to 21 inches; brown (10YR 4/3) fine sand; very weak fine granular structure easily parting to single grain; loose; few fine roots; medium acid; abrupt wavy boundary.

E&Bt—21 to 60 inches; grayish brown (10YR 5/2) and brown (10YR 4/3) fine sand (E); very weak thick platy structure parting to single grain; loose; dark yellowish brown (10YR 4/4) loamy fine sand lamellae (Bt) 0.25 inch to 3.0 inches thick; weak thin, medium, and thick platy structure parting to weak fine subangular blocky; very friable; few fine roots; medium acid and slightly acid.

The solum ranges from 38 to more than 60 inches in thickness. It is strongly acid to neutral. The content of pebbles ranges from 0 to 10 percent.

The A or Ap horizon has value of 3 or 4 and chroma of 2 to 4. It is dominantly loamy fine sand, but the range includes loamy sand and fine sand. The E horizon has value of 4 to 6 and chroma of 2 or 3. It is fine sand, sand, or loamy fine sand. The depth to the uppermost lamella in the E&Bt horizon ranges from 15 to 36 inches. Individual lamellae are 1/8 inch to 5 inches thick and are 2 to 12 inches apart. They are loamy sand, loamy fine sand, fine sandy loam, or sandy loam. Some pedons have a C horizon. This horizon has hue of 10YR, value of 5 to 7, and chroma of 3 or 4. It is fine sand or loamy sand. It is mildly alkaline or moderately alkaline.

Tappan Series

The Tappan series consists of poorly drained soils on lake plains and till plains. These soils formed in calcareous, loamy till. Permeability is moderate or moderately slow in the upper part of the pedon and slow in the lower part. Slope is 0 to 2 percent.

Tappan soils are similar to Pella and Wolcott soils and are commonly adjacent to Avoca, Essexville, and Londo soils. Pella soils have more silt throughout the solum than the Tappan soils. Wolcott soils are noncalcareous in the upper part. Avoca and Essexville soils are coarser textured in the upper part than the Tappan soils. Avoca soils are somewhat poorly drained and are in the higher positions on the landscape. Essexville soils are in landscape positions similar to those of the Tappan soils. Londo soils are somewhat poorly drained, are noncalcareous in the upper part, and are in the higher positions on the landscape.

Typical pedon of Tappan loam, in an area of Tappan-Londo loams, 0 to 2 percent slopes, 1,056 feet west and 100 feet north of the southeast corner of sec. 17, T. 13 N., R. 9 E.

Ap—0 to 11 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slight effervescence; neutral; abrupt smooth boundary.

Bg—11 to 19 inches; dark gray (5Y 4/1) loam; common medium prominent dark yellowish brown (10YR 4/4) mottles; weak fine angular blocky structure; friable; strong effervescence; mildly alkaline; abrupt irregular boundary.

Cg1—19 to 30 inches; dark grayish brown (10YR 4/2) loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak fine angular blocky structure; firm; strong effervescence; mildly alkaline; abrupt irregular boundary.

Cg2—30 to 45 inches; grayish brown (10YR 5/2) loam; many medium faint gray (10YR 5/1) mottles; weak coarse angular blocky structure; firm; strong effervescence; mildly alkaline; abrupt irregular boundary.

C—45 to 60 inches; brown (10YR 4/3) loam; many medium faint dark grayish brown (10YR 4/2) mottles; massive; firm; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 13 to 33 inches. The content of pebbles and cobbles ranges from 0 to 5 percent in the solum.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam and sandy loam. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. It is loam, silt loam, or clay loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 3. It is loam or clay loam.

Thetford Series

The Thetford series consists of somewhat poorly drained, moderately rapidly permeable soils on outwash plains and moraines. These soils formed in sandy glacial till or glaciofluvial material. Slope ranges from 0 to 4 percent.

These soils have a mollic surface layer, which is not definitive for the Thetford series. This difference, however, does not alter the usefulness or behavior of the soils.

Thetford soils are similar to Ottokee soils and are commonly adjacent to Granby and Ottokee soils. Ottokee soils are moderately well drained and are in the slightly higher positions on the landscape. They have fewer and thinner lamellae than the Thetford soils. Granby soils are poorly drained and are in the lower positions on the landscape.

Typical pedon of Thetford loamy fine sand, 0 to 4 percent slopes, 450 feet east and 1,370 feet south of the northwest corner of sec. 33, T. 11 N., R. 8 E.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

E1—12 to 15 inches; yellowish brown (10YR 5/4) loamy fine sand; common fine distinct dark yellowish brown (10YR 4/6, 3/6) mottles; weak medium subangular blocky structure parting to single grain; very friable; slightly acid; clear wavy boundary.

E2—15 to 26 inches; yellowish brown (10YR 5/4) fine sand; few fine prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure parting to single grain; very friable; neutral; clear wavy boundary.

Bt—26 to 30 inches; dark yellowish brown (10YR 4/4) loamy fine sand; few fine distinct dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure parting to single grain; very friable; neutral; clear wavy boundary.

E&Bt—30 to 53 inches; yellowish brown (10YR 5/6) fine sand (E); few fine distinct grayish brown (10YR 5/2) mottles; single grain; loose; dark yellowish brown (10YR 4/4) loamy fine sand lamellae (E) 0.25 inch to 3.0 inches thick, 9 inches total thickness; very weak thick platy structure and single grain; very friable; neutral; clear wavy boundary.

C—53 to 60 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to more than 60 inches. Reaction ranges from medium acid to neutral in the upper part of the pedon and from slightly acid to mildly alkaline in the lower part. The content of pebbles is 0 to 4 percent in the solum.

The A horizon has value of 2 to 4 and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes fine sand and loamy sand. The E horizon has value of 4 to 6 and chroma of 3 or 4. It is fine sand, loamy fine sand, or loamy sand. The E part of the E&Bt horizon has value of 4 to 6 and chroma of 3 to 6. It is fine sand, loamy sand, or loamy fine sand. The Bt horizon and the B part of the E&Bt horizon have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. They are loamy fine sand, loamy sand, or sandy loam. The C horizon has value of 5 or 6 and chroma of 1 to 4. It is very fine sand, fine sand, or sand.

Thomas Series

The Thomas series consists of very poorly drained soils on lake plains. These soils formed in organic deposits less than 16 inches thick and in the underlying calcareous, loamy, silty, and sandy material. Permeability is moderate in the upper part of the pedon and slow or moderately slow in the lower part. Slope is 0 to 2 percent.

Thomas soils are similar to Olentangy soils and are commonly adjacent to Tappan soils. Olentangy soils are noncalcareous coprogenous earth in the upper part. Tappan soils are poorly drained, have a loamy surface layer, and are in the slightly higher positions on the landscape.

Typical pedon of Thomas muck, 2,330 feet west and 110 feet north of the southeast corner of sec. 30, T. 14 N., R. 8 E.

Op—0 to 12 inches; black (N 2/0), broken face and rubbed, sapric material; weak fine granular structure; friable; many fine roots; about 39 percent organic matter; neutral; abrupt smooth boundary.

Bg—12 to 24 inches; dark gray (10YR 4/1) loam; many medium distinct brown (10YR 4/3) mottles; weak medium angular blocky structure; firm; few fine vertical tubular pores; slight effervescence; mildly alkaline; clear wavy boundary.

Cg—24 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium prominent dark yellowish brown (10YR 4/6) mottles; weak fine columnar structure parting to very weak medium angular blocky; firm; few fine vertical tubular pores; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1—30 to 36 inches; brown (10YR 5/3) stratified silt loam and loamy sand; few fine faint yellowish brown (10YR 5/4) mottles; massive; violent effervescence; mildly alkaline; abrupt smooth boundary.

C2—36 to 47 inches; brown (10YR 5/3) silt loam; many coarse prominent yellowish brown (10YR 5/8) mottles; massive; violent effervescence; mildly alkaline; abrupt wavy boundary.

C3—47 to 60 inches; brown (10YR 5/3) loam; many fine faint dark yellowish brown (10YR 4/4) mottles; massive; friable; about 3 percent pebbles; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 12 to 24 inches. The content of pebbles ranges from 0 to 5 percent in the solum.

The O horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. It is dominantly muck, but the range includes mucky loam and mucky sandy loam. This horizon is neutral to moderately alkaline. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is dominantly loam, clay loam, or silty clay loam, but it has strata of silty clay in some pedons. It is mildly alkaline or moderately alkaline. The C horizon has value of 4 to 6 and chroma of 1 to 4. It is loam, silt loam, silty clay loam, or clay loam and has strata of silty clay and loamy sand.

Tobico Series

The Tobico series consists of poorly drained, very rapidly permeable soils on outwash plains and lake plains. These soils formed in calcareous, sandy glaciofluvial material. Slope is 0 to 2 percent.

These soils have a mollic surface layer, which is not definitive for the Tobico series. The difference, however, does not alter the usefulness or behavior of the soils.

Tobico soils are similar to Granby soils and are commonly adjacent to Bach, Pipestone, and Wasepi soils. Granby soils are noncalcareous in the upper part. Bach soils are finer textured throughout than the Tobico soils. They are in landscape positions similar to those of the Tobico soils. Pipestone soils are somewhat poorly drained, have a spodic horizon, and are noncalcareous. Wasepi soils are somewhat poorly drained, have an argillic horizon, and are noncalcareous in the upper part. Pipestone and Wasepi soils are in the higher positions on the landscape.

Typical pedon of Tobico loamy fine sand, 1,056 feet north and 100 feet west of the southeast corner of sec. 2, T. 14 N., R. 10 E.

Ap—0 to 12 inches; very dark grayish brown (2.5Y 3/2) loamy fine sand, grayish brown (2.5Y 5/2) dry; weak fine and medium granular structure; friable; common fine white (10YR 8/1) shell fragments; few fine roots; strong effervescence; mildly alkaline; abrupt smooth boundary.

Cg1—12 to 24 inches; grayish brown (10YR 5/2) gravelly sand; very weak fine angular blocky structure; very friable and loose; about 20 percent pebbles; uncoated sand grains; strong effervescence; mildly alkaline; abrupt smooth boundary.

Cg2—24 to 60 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; slight effervescence; moderately alkaline.

The content of shell fragments ranges from 0 to 10 percent throughout the pedon. The Ap horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. It is loamy fine sand, sandy loam, or the mucky analogs of these textures. The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is sand, fine sand, or gravelly sand. The content of pebbles in this horizon ranges from 0 to 25 percent.

Wasepi Series

The Wasepi series consists of somewhat poorly drained soils on outwash plains and in glacial drainageways. These soils formed in loamy material underlain by sandy deposits. Permeability is moderately rapid in the upper part of the pedon and very rapid in the lower part. Slope ranges from 0 to 3 percent.

Wasepi soils are commonly adjacent to Boyer, Gilford, and Perrin soils. Boyer soils are well drained and are in the higher positions on the landscape. Gilford soils are very poorly drained and are in the lower positions on the landscape. Perrin soils are moderately well drained and are slightly higher on the landscape than the Wasepi soils.

Typical pedon of Wasepi sandy loam, 0 to 3 percent slopes, 145 feet east and 3,482 feet south of the northwest corner of sec. 7, T. 14 N., R. 11 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; weak medium granular structure; friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

Bt1—9 to 19 inches; yellowish brown (10YR 5/4) sandy loam; many medium distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; weak medium subangular blocky structure; firm; about 5 percent pebbles; strong effervescence; moderately alkaline; abrupt irregular boundary.

Bt2—19 to 24 inches; dark grayish brown (10YR 4/2) sandy loam; common fine faint grayish brown (10YR 5/2) mottles; massive; firm; about 10 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

2C1—24 to 42 inches; grayish brown (10YR 5/2) loamy sand; few fine faint yellowish brown (10YR 5/4) mottles; single grain; loose; about 15 percent pebbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

2C2—42 to 60 inches; yellowish brown (10YR 5/6) coarse sand and very gravelly sand; single grain; loose; about 40 percent pebbles; strong effervescence; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness. It is medium acid to moderately alkaline. The content of pebbles ranges from 3 to 25 percent in the solum and from 15 to 45 percent in the 2C horizon.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. It is sandy loam, loamy sand, or the gravelly analogs of these textures. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 5. It is loamy sand, sandy loam, gravelly sandy loam, or gravelly sandy clay loam. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 6. It is gravel, loamy sand, gravelly sand, or stratified coarse sand and very gravelly sand.

Wixom Series

The Wixom series consists of somewhat poorly drained soils on lake plains, till plains, and outwash plains. These soils formed in sandy, silty, and loamy material. Permeability is rapid in the upper part of the pedon and moderately slow in the lower part. Slope ranges from 0 to 4 percent.

Wixom soils are commonly adjacent to Belleville, Pipestone, and Wolcott soils. Belleville soils are poorly drained and are in the lower positions on the landscape. They do not have a spodic horizon. Pipestone soils do not have an argillic horizon or loamy material within a depth of 40 inches. They are in positions on the landscape similar to those of the Wixom soils. Wolcott soils are very poorly drained, do not have a spodic horizon, and are finer textured in the upper part than the

Wixom soils. They are in the lower positions on the landscape.

Typical pedon of Wixom loamy fine sand, 0 to 4 percent slopes, 788 feet south and 150 feet east of the northwest corner of sec. 13, T. 10 N., R. 7 E.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak medium granular structure; very friable; medium acid; abrupt smooth boundary.

Bs1—9 to 15 inches; dark brown (10YR 3/3) loamy fine sand; weak medium subangular blocky structure; very friable; slightly acid; abrupt wavy boundary.

Bs2—15 to 20 inches; dark yellowish brown (10YR 4/4) fine sand; very weak medium subangular blocky structure; very friable; slightly acid; clear wavy boundary.

E—20 to 23 inches; brown (10YR 5/3) fine sand; few fine faint dark yellowish brown (10YR 4/4) mottles; weak thick platy structure parting to weak medium subangular blocky; very friable; neutral; abrupt wavy boundary.

Bt1—23 to 28 inches; dark yellowish brown (10YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; neutral; abrupt smooth boundary.

2Bt2—28 to 32 inches; grayish brown (10YR 5/2) silty clay loam; few fine faint yellowish brown (10YR 5/4) mottles; weak thick platy structure parting to weak medium angular blocky; friable; neutral; abrupt smooth boundary.

2C1—32 to 47 inches; gray (10YR 5/1) silt loam; common fine faint grayish brown and brown (10YR 5/2, 5/3) mottles; massive; friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

2C2—47 to 60 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct gray (10YR 5/1) mottles; massive; friable; strong effervescence; moderately alkaline.

The solum ranges from 24 to 45 inches in thickness. The sandy part of the solum is 20 to 40 inches thick. Reaction is medium acid to neutral in the solum and mildly alkaline or moderately alkaline in the substratum. The content of pebbles ranges from 0 to 5 percent in the solum.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes loamy sand and fine sand. Some pedons have an E horizon directly below the A horizon. This E horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. The Bs horizon has hue of 10YR, 7.5YR, or 5YR and value and chroma of 2 to 6. It is loamy fine sand or fine sand. The E horizon below the Bs horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is fine sand, sand, loamy sand, or loamy fine sand. Some pedons do not have a Bt horizon in the lower part of the sandy material. The 2Bt horizon has value of 4 or 5 and chroma of 2 to 4. It is loam, clay loam, silty clay loam, or sandy clay loam. The 2C horizon has value of 4 or 5 and chroma of 1 to 4. It is loam, silt loam, clay loam, or silty clay loam.

Wolcott Series

The Wolcott series consists of very poorly drained, moderately permeable soils on moraines and till plains. These soils formed in loamy till. Slope is 0 to 2 percent.

Wolcott soils are similar to Corunna, Gilford, Pella, and Tappan soils and are commonly adjacent to Capac, Marlette, and Metamora soils. Corunna soils are poorly drained and are coarser textured in the upper part than the Wolcott soils. Gilford soils are coarser textured throughout the solum than the Wolcott soils. Pella soils have more silt throughout the solum than the Wolcott soils. Tappan soils are poorly drained and calcareous in the upper part. Capac, Marlette, and Metamora soils are in the higher positions on the landscape. Capac soils are somewhat poorly drained. Marlette soils are well drained. Metamora soils are somewhat poorly drained and are coarser textured in the upper part than the Wolcott soils.

Typical pedon of Wolcott loam, 1,200 feet west and 200 feet north of southeast corner of sec. 23, T. 13 N., R. 11 E.

Ap—0 to 11 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; weak fine to coarse granular structure; friable; slightly acid; abrupt smooth boundary.

Bg1—11 to 22 inches; olive gray (5Y 4/2) loam; common fine prominent dark yellowish brown (10YR 3/6) mottles; weak fine angular blocky structure; friable; neutral; clear wavy boundary.

Bg2—22 to 32 inches; dark grayish brown (2.5Y 4/2) loam; many fine prominent strong brown (7.5YR 4/6) mottles; weak fine and medium angular blocky structure; friable; neutral; gradual wavy boundary.

C—32 to 60 inches; brown (10YR 4/3) loam; many medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; massive; firm; slight effervescence; moderately alkaline.

The solum ranges from 30 to 48 inches in thickness. It is slightly acid or neutral. The content of pebbles ranges from 0 to 10 percent in the solum.

The Ap horizon has value of 2 or 3 and chroma of 0 or 1. It is dominantly loam, but the range includes clay loam. The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1 or 2. It is loam or clay loam. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 2 to 4. It ranges from neutral to moderately alkaline.

Formation of the Soils

This section relates the five major factors of soil formation to the soils in Tuscola County and explains the processes of soil formation.

Factors of Soil Formation

Soil forms through the interaction of five major factors—the physical, chemical and mineralogical compositions of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the processes of soil formation have acted on the parent material (*4*).

Climate and plant and animal life are the active forces of soil formation. They slowly change the parent material into 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 nature of the parent material affects the kind of soil profile that forms. In extreme cases, it determines the soil profile almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the differentiation of soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The parent materials of the soils in Tuscola County were deposited by glaciers or by glacial meltwater. Some of these materials were reworked and redeposited by the subsequent actions of water and wind. The last glacier covered the county about 6,000 to 12,000 years ago. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Tuscola County were deposited as glacial till, outwash, lacustrine material, alluvium, and organic material.

Glacial till was deposited directly by glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Tuscola County is calcareous sandy loam, loam, or clay loam. Londo soils are an example of soils that formed in glacial till. They typically are medium textured and have a weakly developed structure.

Outwash material was deposited by running water from melting glaciers. The size of the particles varies according to the speed of the stream that carried the material. When the water slowed down, the coarser particles were deposited. The finer particles, such as very fine sand, silt, and clay, were carried by slowly moving water. Outwash deposits generally occur as layers of particles of similar size, such as loamy sand, sand, gravel, and other coarse particles. Boyer soils are an example of soils that formed in outwash deposits.

Lacustrine material was deposited from still, or ponded, glacial meltwater. Because the coarser fragments dropped out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remained to settle out in still water. In Tuscola County the soils formed in lacustrine deposits are typically medium textured. Bach and Sanilac soils are examples.

Alluvium is material recently deposited by floodwater from streams. This material varies in texture, depending on the speed of the water from which it was deposited. Cohoctah soils are an example of soils that formed in alluvium.

Organic material occurs as deposits of plant remains. After the glaciers withdrew from the area, water was left standing in depressions in the outwash plains, flood plains, moraines, and till plains. The plant remains of the grasses and sedges growing around the edges of these lakes did not decompose quickly. This plant residue became part of the organic accumulation. The lakes were eventually filled with organic material and developed into areas of muck. Houghton soils formed in organic material.

Plant and Animal Life

Green plants are the principal organisms that have influenced soil formation in Tuscola County. Bacteria, fungi, earthworms, and human activities 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 in the soil depends on the kinds of plants that grew on the soil. The remains of these plants accumulated on the surface, decayed, and eventually became organic matter. The roots of the plants provided channels for the downward movement of water through the soil and added organic matter as they decayed. Bacteria in the soil help to break down the organic matter into plant nutrients.

The native vegetation in Tuscola County was mainly deciduous trees. Differences in natural soil drainage and variations in parent material affected the composition of the forest species. The well drained and moderately well drained upland soils, such as Guelph, Marlette, and Boyer soils, were covered mainly by sugar maple. Chelsea soils were covered by scrub oak and white pine. The wet soils were covered mainly by red maple, elm, and ash. Examples are Corunna and Wolcott soils, which contain a considerable amount of organic matter.

Climate

Climate determines the kind of plant and animal life on and in the soil and the amount of water available for weathering minerals and transporting soil material. Through its influence on soil temperature, climate also determines the rate of chemical reaction in the soil.

The climate in Tuscola County is cool and humid. It is presumably similar to that under which the soils formed. The soils in Tuscola County differ from soils that formed under a dry, warm climate and from those that formed under a hot, moist climate. The climate is generally uniform throughout the county, although its effect is modified locally by the proximity to Saginaw Bay. Only minor differences among the soils in the county are the result of differences in climate.

Relief

Relief has markedly affected the soils in Tuscola County through its effect on natural drainage, runoff, erosion, plant cover, and soil temperature. The slope of the soils ranges from 0 to 35 percent. Runoff is most rapid on the steeper slopes. In low areas water is temporarily ponded.

The soils in the county range from somewhat excessively drained on the sandy ridgetops to very poorly drained in the depressions. Through its effect on soil aeration, drainage determines the color of the soil. Water and air move freely through well drained soils and slowly through very poorly drained soils. In Chelsea and other soils that are well drained and well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized. Tobico and other soils that are poorly aerated and poorly drained are dull gray and mottled. The Chelsea and Tobico soils formed in similar kinds of parent material.

Time

Generally, a long time is needed for the development of distinct horizons. Differences in the length of time that the parent materials have been in place are commonly reflected in the degree of profile development. Some soils form rapidly. Others form slowly.

The soils in Tuscola County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to the soil-forming factors long enough for the development of distinct horizons. The soils that formed in recent alluvial sediment, however, have not been in place long enough for distinct horizons to develop. Cohoctah and Sloan soils are examples of these young soils. Wolcott soils show the effect of a longer time period on the leaching of lime in the profile.

Processes of Soil Formation

The processes responsible for the development of the soil horizons in the unconsolidated parent material are referred to as soil genesis. The physical, chemical, and biological properties of the various soil horizons are referred to as soil morphology.

Several processes were involved in the development of horizons in the soils of Tuscola County. These are the accumulation of organic matter, the leaching of lime (calcium carbonate) and other bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most of the soils, more than one of these processes have been active in the development of horizons.

As organic matter accumulates at the surface, an A horizon forms. This horizon is mixed into a plow layer, or Ap horizon, if the soil is plowed. In the soils of Tuscola County, the surface layer ranges from high to low in organic matter content. Tobico soils are an example of soils that have a high organic matter content in the surface layer. Chelsea soils are an example of soils that have a low organic matter content.

The leaching of carbonates and other bases has occurred in most of the soils. The leaching of bases generally precedes the translocation of silicate clay minerals. Many of the soils are slightly leached or moderately leached. For example, Wolcott soils are leached of carbonates to a depth of about 29 inches, and Tappan soils still have some carbonates at the surface. The difference in the depth of leaching is a result of variations in the content of carbonates in the parent material and the length of time available for weathering.

Gleying, or the reduction and transfer of iron, is evident in somewhat poorly drained, poorly drained, and very poorly drained soils. A gray color in the subsoil indicates the reduction and loss of iron. Tappan soils are an example of gleyed soils.

The translocation of clay minerals contributes to horizon development in many medium textured soils. An eluviated, or leached, E horizon is lower in content of clay and lighter in color than the illuviated B horizon. The B horizon typically has an accumulation of clay, or clay films, in pores and on the faces of peds. Soils at this stage of formation were probably leached of carbonates and soluable salts to a considerable extent before the translocation of silicate clay took place. Guelph soils are an example.

In some sandy soils iron, aluminum, and humus have moved from the surface layer and subsurface layer to the B horizon. As a result, the B horizon in these soils is dark brown or strong brown. Avoca, Covert, and Pipestone soils are examples. In the sandy Chelsea, Ottokee, Perrin, and Thetford soils, some iron, aluminum, and humus has moved from the surface layer to the Bw or E horizon. As a result, the Bw or E horizon is yellowish brown.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vols., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Deeter, E.B., and A.E. Matthews. 1926. Soil survey of Tuscola County, Michigan. U.S. Dep. Agric., Bur. of Chem. and Soils, 40 pp., illus.

(4) Jenny, Hans. 1941. Factors of soil formation. McGraw-Hill Book Company, Inc., 281 pp., illus.

(5) Michigan Department of Agriculture. 1981, 1982, 1983. Michigan agricultural statistics. 3 vols., illus.

(6) Michigan State University. 1976. Fertilizer recommendations for vegetables and field crops in Michigan. Ext. Bull. E-550, 20 pp.

(7) Mokma, D.L., and E.P. Whiteside. 1974. Soils of Tuscola County, Michigan. 2 vols., illus.

(8) Mokma, D.L., E.P. Whiteside, and I.F. Schneider. 1978. Soil management units and land use planning. Ext. Bull. E-1262, 12 pp.

(9) Padley, E.A., C.C. Trettin, and G.S. LeMasters. [n.d.] Characterization data for selected soils of Tuscola County, Michigan. Ford Forestry Cent., Mich. Tech. Univ., Res. Note 33, 17 pp.

(10) Page, R.H., and company. 1883. History of Tuscola and Bay Counties. 215 pp.

(11) Romig, Walter. 1973. Michigan place names. 673 pp.

(12) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(13) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(14) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Pressurized sewage disposal system. A system of evenly distributing secondary effluent from a holding tank to a stone-filled filter bed. The effluent is distributed under low pressure through small-diameter subsurface pipes that have small, evenly spaced holes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-80 at Caro, Michigan]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	29.1	12.7	20.9	53	-17	0	1.48	0.8	2.1	5	10.4
February---	32.1	13.3	22.7	54	-18	0	1.18	.5	1.8	4	6.9
March------	42.4	22.9	32.6	71	-6	9	2.10	1.1	3.0	6	5.9
April------	58.1	33.7	45.9	83	13	77	2.51	1.8	3.2	7	1.4
May--------	70.3	43.1	56.7	89	24	254	2.55	1.5	3.5	7	**
June-------	80.1	52.7	66.4	95	32	501	3.09	1.8	4.2	6	.0
July-------	84.3	56.7	70.5	96	38	642	2.91	1.5	4.1	6	.0
August-----	82.0	55.1	68.6	95	36	584	2.96	1.6	4.1	5	.0
September--	74.2	48.6	61.4	93	27	356	2.98	1.5	4.2	7	.0
October----	62.4	39.2	50.8	84	18	133	2.29	1.0	3.4	5	.1
November---	47.2	30.3	38.8	71	8	20	2.27	1.4	3.0	6	3.2
December---	34.3	19.5	26.9	60	-9	0	1.88	.9	2.7	6	8.6
Year---	58.0	35.7	46.8	98	-20	2,576	28.21	24.7	31.6	69	36.5

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

** Trace.

TABLE 2.--PRECIPITATION

[Recorded in the period 1951-80 at Sebewaing, Michigan]

Month	Precipitation				
	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
		Less than--	More than--		
	In	In	In		In
January----	1.26	0.7	1.8	4	10.1
February---	1.10	.5	1.6	4	6.6
March------	1.71	.9	2.4	5	5.4
April------	2.22	1.4	2.9	7	1.2
May--------	2.47	1.3	3.5	6	.0
June-------	2.71	1.7	3.6	6	.0
July-------	2.94	1.7	4.1	6	.0
August-----	2.76	1.4	3.9	6	.0
September--	2.81	1.5	4.0	6	.0
October----	2.29	1.1	3.3	6	.3
November---	2.08	1.3	2.8	6	2.5
December---	1.65	.9	2.3	5	7.7
Year---	26.00	22.8	29.1	66	33.8

TABLE 3.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1930-79 at Caro, Michigan]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 10	May 22	June 6
2 years in 10 later than--	May 3	May 17	June 1
5 years in 10 later than--	Apr. 23	May 7	May 22
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 5	Sept. 21	Sept. 11
2 years in 10 earlier than--	Oct. 11	Sept. 28	Sept. 15
5 years in 10 earlier than--	Oct. 24	Oct. 9	Sept. 24

TABLE 4.--GROWING SEASON

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	156	131	101
8 years in 10	166	138	109
5 years in 10	184	153	124
2 years in 10	202	168	139
1 year in 10	211	176	147

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
3A	Shebeon loam, 0 to 1 percent slopes	4,740	0.9
4B	Covert sand, 0 to 6 percent slopes	5,669	1.1
6A	Tappan-Avoca complex, 0 to 3 percent slopes	16,641	3.2
8A	Tappan-Londo loams, 0 to 2 percent slopes	87,388	16.7
10B	Pipestone fine sand, 0 to 4 percent slopes	19,473	3.7
11B	Metamora sandy loam, 0 to 4 percent slopes	7,285	1.4
12	Corunna sandy loam	8,949	1.7
13A	Wixom-Belleville loamy fine sands, 0 to 3 percent slopes	9,473	1.8
14A	Avoca loamy fine sand, 0 to 3 percent slopes	7,306	1.4
18	Essexville loamy fine sand	8,825	1.7
19A	Wasepi sandy loam, 0 to 3 percent slopes	6,919	1.3
20B	Guelph-Londo loams, 0 to 6 percent slopes	29,096	5.6
20C	Guelph loam, 6 to 12 percent slopes	8,130	1.6
20D2	Guelph loam, 12 to 18 percent slopes, eroded	372	0.1
21B	Wixom loamy fine sand, 0 to 4 percent slopes	9,534	1.8
25A	Londo loam, 0 to 3 percent slopes	29,124	5.6
26B	Perrin loamy sand, 0 to 4 percent slopes	7,435	1.4
27B	Boyer sandy loam, 0 to 6 percent slopes	16,749	3.2
27C	Boyer sandy loam, 6 to 12 percent slopes	2,070	0.4
28B	Marlette-Capac complex, 0 to 6 percent slopes	18,544	3.5
28C	Marlette sandy loam, 6 to 12 percent slopes	13,986	2.7
28D	Marlette sandy loam, 12 to 18 percent slopes	3,942	0.8
28E	Marlette sandy loam, 18 to 35 percent slopes	1,383	0.3
29B	Metea loamy fine sand, 1 to 6 percent slopes	2,820	0.5
30B	Spinks loamy fine sand, 0 to 6 percent slopes	6,498	1.2
30C	Spinks loamy fine sand, 6 to 12 percent slopes	2,541	0.5
30D	Spinks loamy fine sand, 12 to 18 percent slopes	1,431	0.3
30E	Spinks loamy fine sand, 18 to 35 percent slopes	1,145	0.2
32B	Thetford loamy fine sand, 0 to 4 percent slopes	4,794	0.9
33	Granby loamy fine sand	16,793	3.2
35	Wolcott loam	10,469	2.0
36	Tappan loam	47,756	9.1
37	Adrian muck	1,518	0.3
38	Tobico loamy fine sand	2,645	0.5
39B	Ottokee loamy fine sand, 0 to 6 percent slopes	12,700	2.4
40B	Chelsea fine sand, 0 to 6 percent slopes	3,352	0.6
40C	Chelsea fine sand, 6 to 12 percent slopes	2,161	0.4
42	Gilford sandy loam	8,928	1.7
45	Houghton muck	7,192	1.4
52A	Landes fine sandy loam, 0 to 3 percent slopes	778	0.1
53	Sloan loam	1,968	0.4
54B	Capac loam, 1 to 5 percent slopes	19,507	3.7
55	Cohoctah sandy loam	7,821	1.5
56	Edwards muck	1,569	0.3
57	Palms muck	2,832	0.5
58	Thomas muck	932	0.2
59	Pella silt loam	1,608	0.3
62A	Sanilac silt loam, 0 to 3 percent slopes	5,508	1.1
63	Bach very fine sandy loam	3,593	0.7
64	Tappan-Lenawee Variant complex	370	0.1
65B	Fulton silty clay loam, 1 to 5 percent slopes	501	0.1
66	Latty silty clay loam	1,857	0.4
67B	Pipestone fine sand, loamy substratum, 0 to 4 percent slopes	1,595	0.3
69	Edwards-Adrian mucks	2,254	0.4
71A	Rapson loamy fine sand, 0 to 3 percent slopes	3,101	0.6
75	Aquents, ponded	1,759	0.3
76	Pits	1,413	0.3
77	Aquents-Psamments complex, gently undulating	3,625	0.7
78	Olentangy mucky silt loam	940	0.2
	Water areas less than 40 acres in size	424	0.1
	Water areas more than 40 acres in size	3,264	0.6
	Total	522,995	100.0

TABLE 6.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
3A	Shebeon loam, 0 to 1 percent slopes (where drained)
6A	Tappan-Avoca complex, 0 to 3 percent slopes (where drained)
8A	Tappan-Londo loams, 0 to 2 percent slopes (where drained)
11B	Metamora sandy loam, 0 to 4 percent slopes (where drained)
12	Corunna sandy loam (where drained)
13A	Wixom-Belleville loamy fine sands, 0 to 3 percent slopes (where drained)
14A	Avoca loamy fine sand, 0 to 3 percent slopes (where drained)
20B	Guelph-Londo loams, 0 to 6 percent slopes (where drained)
21B	Wixom loamy fine sand, 0 to 4 percent slopes (where drained)
25A	Londo loam, 0 to 3 percent slopes (where drained)
28B	Marlette-Capac complex, 0 to 6 percent slopes (where drained)
29B	Metea loamy fine sand, 1 to 6 percent slopes
35	Wolcott loam (where drained)
36	Tappan loam (where drained)
42	Gilford sandy loam (where drained)
52A	Landes fine sandy loam, 0 to 3 percent slopes
53	Sloan loam (where drained and either protected from flooding or not frequently flooded during the growing season)
54B	Capac loam, 1 to 5 percent slopes (where drained)
55	Cohoctah sandy loam (where drained and either protected from flooding or not frequently flooded during the growing season)
58	Thomas muck (where drained)
59	Pella silt loam (where drained)
62A	Sanilac silt loam, 0 to 3 percent slopes (where drained)
63	Bach very fine sandy loam (where drained)
64	Tappan-Lenawee Variant complex (where drained)
65B	Fulton silty clay loam, 1 to 5 percent slopes (where drained)
66	Latty silty clay loam (where drained)
71A	Rapson loamy fine sand, 0 to 3 percent slopes (where drained)

TABLE 7.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Corn	Dry beans	Winter wheat	Sugar beets	Soybeans	Oats	Grass-legume hay
		Bu	Bu	Bu	Tons	Bu	Bu	Tons
3A Shebeon	IIw	120	30	60	20	40	100	5.0
4B Covert	IVs	50	---	30	---	---	45	3.0
6A Tappan-Avoca	IIw	120	28	60	20	35	100	4.6
8A Tappan-Londo	IIw	135	30	65	22	40	106	4.9
10B Pipestone	IVw	60	---	30	---	---	60	3.0
11B Metamora	IIw	110	23	60	17	36	95	4.0
12 Corunna	IIw	120	23	65	18	40	100	4.5
13A Wixom-Belleville	IIIw	99	18	47	---	35	82	3.9
14A Avoca	IIIw	100	18	45	18	35	80	4.2
18 Essexville	IIIw	100	20	54	18	35	85	4.0
19A Wasepi	IIIs	80	18	35	---	30	60	3.4
20B Guelph-Londo	IIe	114	22	52	20	38	100	4.9
20C Guelph	IIIe	90	17	40	---	30	85	4.8
20D2 Guelph	IVe	---	---	28	---	---	70	4.0
21B Wixom	IIIw	95	18	45	---	35	80	3.8
25A Londo	IIw	128	28	60	20	40	100	5.0
26B Perrin	IIIs	75	16	35	---	28	60	3.0
27B Boyer	IIIs	80	18	35	---	30	60	3.4
27C Boyer	IIIe	70	---	32	---	26	55	2.8

TABLE 7.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Dry beans	Winter wheat	Sugar beets	Soybeans	Oats	Grass-legume hay
		Bu	Bu	Bu	Tons	Bu	Bu	Tons
28B------------- Marlette-Capac	IIe	110	17	60	---	35	85	4.2
28C------------- Marlette	IIIe	100	---	56	---	27	75	3.5
28D------------- Marlette	IVe	85	---	48	---	---	65	3.2
28E------------- Marlette	VIe	---	---	---	---	---	---	3.2
29B------------- Metea	IIIe	85	17	42	---	30	---	2.8
30B------------- Spinks	IIIs	75	15	30	---	27	60	3.0
30C------------- Spinks	IIIe	68	---	30	---	23	55	2.4
30D------------- Spinks	IVe	---	---	24	---	---	50	1.8
30E------------- Spinks	VIe	---	---	---	---	---	---	1.8
32B------------- Thetford	IIIw	80	16	35	---	30	60	3.0
33-------------- Granby	Vw	---	---	---	---	---	---	---
35-------------- Wolcott	IIw	140	30	60	23	40	105	4.8
36-------------- Tappan	IIw	140	33	65	23	40	110	4.8
37-------------- Adrian	Vw	---	---	---	---	---	---	---
38-------------- Tobico	IIIw	70	---	35	---	23	55	---
39B------------- Ottokee	IIIs	70	17	30	---	27	55	3.5
40B------------- Chelsea	IVs	68	---	---	---	21	41	2.0
40C------------- Chelsea	VIs	---	---	---	---	---	32	1.5
42-------------- Gilford	IIIw	90	17	45	---	30	60	3.8
45-------------- Houghton	Vw	---	---	---	---	---	---	---
52A------------- Landes	IIIw	100	---	34	---	26	47	2.8

TABLE 7.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Dry beans	Winter wheat	Sugar beets	Soybeans	Oats	Grass-legume hay
		Bu	Bu	Bu	Tons	Bu	Bu	Tons
53-------------- Sloan	IIIw	126	---	---	23	35	---	4.5
54B------------- Capac	IIe	120	23	62	19	36	95	4.5
55-------------- Cohoctah	Vw	---	---	---	---	---	---	3.0
56-------------- Edwards	Vw	---	---	---	---	---	---	---
57-------------- Palms	Vw	---	---	---	---	---	---	---
58-------------- Thomas	IIw	125	---	35	---	32	65	3.5
59-------------- Pella	IIw	125	---	50	---	40	75	4.8
62A------------- Sanilac	IIw	130	30	60	20	40	85	4.5
63-------------- Bach	IIw	137	31	60	23	38	85	4.5
64-------------- Tappan-Lenawee Variant	IIIw	80	---	39	18	---	80	4.2
65B------------- Fulton	IIIe	95	---	40	---	35	75	4.0
66-------------- Latty	IIIw	112	---	46	---	38	82	4.0
67B------------- Pipestone	IIIw	80	---	35	---	---	65	3.5
69-------------- Edwards-Adrian	Vw	---	---	---	---	---	---	---
71A------------- Rapson	IIIw	95	18	45	---	35	80	3.8
75-------------- Aquents	VIIIw	---	---	---	---	---	---	---
76*. Pits								
77. Aquents-Psamments								
78-------------- Olentangy	IIIw	100	---	35	---	32	65	3.5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	---	---	---	---
II	291,140	67,147	223,993	---
III	152,487	34,842	67,344	50,301
IV	34,239	5,745	19,473	9,021
V	29,955	---	29,955	---
VI	4,689	2,528	---	2,161
VII	---	---	---	---
VIII	---	---	---	---

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
3A----------------- Shebeon	3W	Slight	Moderate	Slight	Moderate	Northern red oak----	56	39	White spruce, northern white-cedar, eastern white pine.
						White ash-----------	56	40	
						Bitternut hickory---	---	---	
						Green ash-----------	56	40	
						Shagbark hickory----	---	---	
						American basswood---	56	36	
						Silver maple--------	91	---	
						Red maple-----------	56	36	
4B----------------- Covert	3S	Slight	Moderate	Severe	Slight	Northern red oak----	67	49	Red pine, black walnut, eastern white pine.
						Red maple-----------	66	41	
						Black cherry--------	---	---	
						Eastern cottonwood--	---	---	
						American basswood---	---	---	
						White oak-----------	---	---	
						Quaking aspen-------	---	---	
						American beech------	---	---	
						Eastern white pine--	---	---	
6A**:									
Tappan------------	3W	Slight	Severe	Moderate	Moderate	Red maple-----------	66	41	Northern white-cedar, eastern white pine, white spruce.
						Silver maple--------	91	42	
						Swamp white oak-----	---	---	
						White ash-----------	66	65	
						Bur oak-------------	66	48	
						Black ash-----------	---	---	
Avoca-------------	2W	Slight	Moderate	Moderate	Moderate	Red maple-----------	56	36	White spruce, black spruce, eastern white pine.
						Northern red oak----	56	39	
						Eastern cottonwood--	---	---	
						White ash-----------	56	40	
						Silver maple--------	82	36	
						Black ash-----------	---	---	
						Shagbark hickory----	---	---	
						Swamp white oak-----	---	---	
8A**:									
Tappan------------	3W	Slight	Severe	Moderate	Moderate	Red maple-----------	66	41	Northern white-cedar, eastern white pine, white spruce.
						Silver maple--------	91	43	
						Swamp white oak-----	---	---	
						White ash-----------	66	65	
						Bur oak-------------	66	48	
						Black ash-----------	---	---	

See footnotes at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
8A**:									
Londo	4W	Slight	Moderate	Slight	Moderate	Green ash	66	65	White spruce, eastern white pine.
						Northern red oak	66	48	
						Black oak	---	---	
						Red maple	66	41	
						American basswood	66	41	
						Eastern cottonwood	---	---	
						White ash	65	63	
10B Pipestone	3W	Slight	Moderate	Slight	Moderate	Red maple	65	40	White spruce, eastern white pine.
						White ash	---	---	
						Eastern cottonwood	---	---	
						Bitternut hickory	---	---	
						American basswood	56	36	
						Eastern white pine	64	153	
11B Metamora	3W	Slight	Moderate	Slight	Moderate	Northern red oak	62	45	White spruce, Norway spruce, eastern white pine, northern white-cedar.
						White ash	---	---	
						Bitternut hickory	---	---	
						Green ash	---	---	
						Shagbark hickory	---	---	
						American basswood	---	---	
						Sugar maple	---	---	
						Red maple	---	---	
12 Corunna	2W	Slight	Severe	Moderate	Moderate	Silver maple	82	36	Eastern white pine, white spruce.
						Red maple	56	36	
						White ash	---	---	
						American basswood	---	---	
						American sycamore	---	---	
						Swamp white oak	---	---	
13A**:									
Wixom	6W	Slight	Moderate	Slight	Moderate	Quaking aspen	70	81	Eastern white pine, white spruce.
						American beech	---	---	
						Northern red oak	---	---	
						Red maple	66	41	
						American basswood	---	---	
Belleville	1W	Slight	Severe	Moderate	Moderate	Silver maple	64	20	
						Red maple	---	---	
						White ash	---	---	
						Pin oak	---	---	
						Swamp white oak	---	---	

See footnotes at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
14A----------------- Avoca	2W	Slight	Moderate	Moderate	Slight	Red maple-----------	56	36	White spruce, eastern white pine.
						Northern red oak----	56	39	
						Eastern cottonwood--	---	---	
						White ash-----------	56	40	
						Silver maple--------	82	36	
						Black ash-----------	---	---	
						Shagbark hickory----	---	---	
						Swamp white oak-----	---	---	
18----------------- Essexville	1W	Slight	Severe	Severe	Severe	White ash-----------	40	18	White spruce, green ash, eastern white pine.
						Pin oak-------------	---	---	
						Eastern cottonwood--	---	---	
						American basswood---	40	24	
						Swamp white oak-----	---	---	
						Red maple-----------	40	24	
						Quaking aspen-------	40	22	
19A---------------- Wasepi	4W	Slight	Moderate	Slight	Moderate	Quaking aspen-------	60	64	White spruce, eastern white pine, Norway spruce, imperial Carolina poplar.
						Red maple-----------	---	---	
						Silver maple--------	---	---	
						Paper birch---------	---	---	
20B**:									
Guelph------------	3A	Slight	Slight	Slight	Slight	Sugar maple---------	61	38	Imperial Carolina poplar, eastern white pine.
						Northern red oak----	---	---	
						Eastern white pine--	---	---	
						White oak-----------	---	---	
						Black cherry--------	---	---	
						Red pine------------	---	---	
Londo-------------	4W	Slight	Moderate	Slight	Moderate	Green ash-----------	66	65	White spruce, eastern white pine.
						Northern red oak----	66	48	
						Black oak-----------	---	---	
						Red maple-----------	66	41	
						American basswood---	66	41	
						Eastern cottonwood--	---	---	
						White ash-----------	65	63	
20C, 20D2---------- Guelph	3A	Slight	Slight	Slight	Slight	Sugar maple---------	61	38	White spruce, eastern white pine, red pine, imperial Carolina poplar.
						Northern red oak----	---	---	
						Eastern white pine--	---	---	
						White oak-----------	---	---	
						Black cherry--------	---	---	
						Red pine------------	---	---	

See footnotes at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
21B: Wixom	6W	Slight	Moderate	Slight	Moderate	Quaking aspen	70	81	Eastern white pine, white spruce.
						American beech	---	---	
						Northern red oak	---	---	
						Red maple	66	41	
						American basswood	---	---	
25A: Londo	4W	Slight	Moderate	Slight	Moderate	Green ash	66	65	White spruce, eastern white pine.
						Northern red oak	66	48	
						Black oak	---	---	
						Red maple	66	41	
						American basswood	66	41	
						Eastern cottonwood	---	---	
						White ash	65	63	
26B: Perrin	3S	Slight	Slight	Moderate	Slight	Northern red oak	66	48	Eastern white pine, red pine, Norway spruce, imperial Carolina poplar, white spruce.
						White oak	---	---	
						Sugar maple	---	---	
						American beech	---	---	
						American basswood	---	---	
						Shagbark hickory	---	---	
27B, 27C: Boyer	3A	Slight	Slight	Slight	Slight	Northern red oak	66	48	Eastern white pine, red pine, Norway spruce, imperial Carolina poplar.
						White oak	---	---	
						American basswood	---	---	
						Sugar maple	---	---	
						Black oak	---	---	
28B**:									
Marlette	3A	Slight	Slight	Slight	Slight	Sugar maple	65	40	Eastern white pine, red pine, white spruce.
						Northern red oak	69	51	
						White ash	---	---	
						American basswood	---	---	
						Black cherry	---	---	
						White oak	---	---	
Capac	3W	Slight	Moderate	Slight	Moderate	Northern red oak	65	47	Eastern white pine, white spruce, Norway spruce.
						American basswood	---	---	
						Northern pin oak	---	---	
						White ash	---	---	
						Red maple	---	---	
						Bitternut hickory	---	---	
						Sugar maple	---	---	
						Black cherry	---	---	
						American beech	---	---	

See footnotes at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
28C, 28D----------- Marlette	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	Eastern white pine, red pine, white spruce.
						Northern red oak----	69	51	
						White ash-----------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
						White oak-----------	---	---	
28E---------------- Marlette	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	65	40	Eastern white pine, red pine, white spruce.
						Northern red oak----	69	51	
						White ash-----------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
						White oak-----------	---	---	
29B---------------- Metea	3S	Slight	Moderate	Moderate	Slight	Northern red oak----	66	48	Eastern white pine, red pine, white spruce, Norway spruce.
						White oak-----------	---	---	
						Sugar maple---------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
						Shagbark hickory----	---	---	
30B, 30C, 30D------ Spinks	3S	Slight	Slight	Moderate	Slight	Northern red oak----	66	48	Red pine, eastern white pine, imperial Carolina poplar.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
30E---------------- Spinks	3R	Moderate	Moderate	Moderate	Slight	Northern red oak----	66	48	Red pine, eastern white pine, imperial Carolina poplar.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
32B---------------- Thetford	3W	Slight	Moderate	Slight	Moderate	Red maple-----------	65	40	White spruce, Norway spruce, eastern white pine, imperial Carolina poplar.
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern cottonwood--	---	---	
						Northern red oak----	---	---	
						Swamp white oak-----	---	---	
						Bitternut hickory---	---	---	
33----------------- Granby	2W	Slight	Severe	Severe	Severe	Silver maple--------	82	36	Eastern white pine, Norway spruce, white spruce.
						Red maple-----------	68	42	
						American basswood---	---	---	
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern cottonwood--	---	---	

See footnotes at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
35 Wolcott	3W	Slight	Severe	Severe	Moderate	Red maple	66	41	Eastern white pine, Norway spruce, white ash.
						Pin oak	---	---	
						White oak	---	---	
						Northern red oak	---	---	
						Silver maple	---	---	
36 Tappan	3W	Slight	Severe	Moderate	Moderate	Red maple	66	41	Northern white-cedar, eastern white pine, white spruce.
						Silver maple	91	43	
						Swamp white oak	---	---	
						White ash	66	65	
						Bur oak	66	48	
						Black ash	---	---	
37 Adrian	2W	Slight	Severe	Severe	Severe	Silver maple	78	32	
						Red maple	53	34	
						White ash	69	73	
						Quaking aspen	60	64	
						Tamarack	45	35	
						Green ash	69	73	
38 Tobico	1W	Slight	Severe	Severe	Severe	White ash	40	18	
						Red maple	40	18	
						Eastern cottonwood	---	---	
						Swamp white oak	---	---	
39B Ottokee	3S	Slight	Slight	Moderate	Slight	Northern red oak	65	47	Eastern white pine, white spruce, red pine, imperial Carolina poplar.
						White oak	---	---	
						Quaking aspen	---	---	
						White ash	---	---	
						Red maple	---	---	
						Bur oak	---	---	
40B, 40C Chelsea	4S	Slight	Moderate	Moderate	Slight	White oak	70	52	Eastern white pine, red pine, jack pine.
						Red pine	72	134	
						Eastern white pine	83	170	
						Jack pine	70	106	
						Quaking aspen	72	84	
						Northern red oak	70	52	
42 Gilford	2W	Slight	Severe	Severe	Severe	Red maple	56	36	Eastern white pine, white spruce.
						Silver maple	---	---	
						American basswood	---	---	
						Bur oak	---	---	
						White ash	---	---	
						Swamp white oak	---	---	

See footnotes at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
45----------------- Houghton	2W	Slight	Severe	Severe	Severe	Silver maple-------- Red maple----------- White ash----------- Quaking aspen------- Tamarack------------ Green ash----------- Northern white-cedar	82 56 56 60 45 --- 37	36 36 40 64 35 --- 55	
52A---------------- Landes	4A	Slight	Slight	Slight	Slight	Northern red oak---- Eastern cottonwood-- White ash----------- Red maple----------- American basswood---	70 --- --- --- ---	52 --- --- --- ---	Eastern white pine.
53----------------- Sloan	3W	Slight	Severe	Severe	Severe	Red maple----------- Swamp white oak----- White ash----------- Green ash----------- Eastern cottonwood-- Pin oak-------------	66 --- 66 66 --- ---	41 --- 65 65 --- ---	Northern white-cedar, eastern cottonwood.
54B---------------- Capac	3W	Slight	Moderate	Slight	Moderate	Northern red oak---- American basswood--- Northern pin oak---- White ash----------- Red maple----------- Bitternut hickory--- Sugar maple--------- Black cherry-------- American beech------	65 --- --- --- --- --- --- --- ---	48 --- --- --- --- --- --- --- ---	Eastern white pine, white spruce, Norway spruce.
55----------------- Cohoctah	2W	Slight	Severe	Severe	Moderate	Silver maple-------- Red maple----------- Eastern cottonwood-- White ash----------- Swamp white oak-----	80 56 --- --- ---	34 36 --- --- ---	Eastern white pine, white spruce, northern white-cedar.
56----------------- Edwards	2W	Slight	Severe	Severe	Severe	Red maple----------- White ash----------- Green ash----------- Tamarack------------ Swamp white oak----- Silver maple--------	56 --- --- --- --- ---	36 --- --- --- --- ---	

See footnotes at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
57 Palms	3W	Slight	Severe	Severe	Severe	Red maple	55	35	
						Silver maple	---	---	
						White ash	---	---	
						Quaking aspen	---	---	
						Northern white-cedar	---	---	
						Tamarack	---	---	
						Black ash	---	---	
58 Thomas	3W	Slight	Severe	Severe	Severe	Red maple	66	41	
						White ash	---	---	
						Black ash	---	---	
						Bur oak	---	---	
						Swamp white oak	---	---	
						Silver maple	---	---	
59 Pella	3W	Slight	Severe	Moderate	Moderate	Northern white-cedar	33	48	Northern white-cedar, white spruce, green ash.
						White ash	---	---	
						Silver maple	---	---	
62A Sanilac	3W	Slight	Moderate	Slight	Moderate	Northern red oak	66	48	White spruce, eastern white pine, northern white-cedar, Norway spruce.
						Red maple	66	41	
						White ash	66	65	
						Sugar maple	61	38	
						Silver maple	91	43	
						American basswood	66	41	
63 Bach	3W	Slight	Severe	Severe	Severe	Red maple	66	41	Northern white-cedar, eastern white pine, white spruce.
						Bur oak	66	48	
						White ash	66	65	
						Black ash	---	---	
						Swamp white oak	---	---	
						Silver maple	91	43	
64**:									
Tappan	3W	Slight	Severe	Moderate	Moderate	Red maple	66	41	Northern white-cedar, eastern white pine, white spruce.
						Silver maple	91	43	
						Swamp white oak	---	---	
						White ash	66	65	
						Bur oak	66	48	
						Black ash	---	---	
Lenawee Variant.									
65B Fulton	3R	Slight	Moderate	Moderate	Severe	Northern red oak	56	39	White spruce, white ash, eastern white pine, northern white-cedar, northern red oak.
						Red maple	56	36	
						Swamp white oak	---	---	
						Black oak	---	---	
						White oak	56	39	

See footnotes at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
66 Latty	1W	Slight	Severe	Severe	Severe	Red maple	45	29	Eastern white pine, Norway spruce.
						White ash	45	22	
						Eastern cottonwood	---	---	
67B Pipestone	3W	Slight	Moderate	Slight	Moderate	Red maple	65	40	White spruce, eastern white pine.
						White ash	---	---	
						Bitternut hickory	---	---	
						American basswood	---	---	
						Eastern cottonwood	---	---	
69**:									
Edwards	2W	Slight	Severe	Severe	Severe	Red maple	56	36	
						White ash	---	---	
						Green ash	---	---	
						Tamarack	---	---	
						Swamp white oak	---	---	
						Silver maple	---	---	
Adrian	2W	Slight	Severe	Severe	Severe	Silver maple	78	32	
						Red maple	53	34	
						White ash	69	73	
						Quaking aspen	60	64	
						Tamarack	45	35	
						Green ash	69	73	
71A Rapson	2W	Slight	Moderate	Slight	Moderate	Red maple	56	36	Northern white-cedar, eastern white pine, white spruce.
						White oak	56	39	
						Eastern cottonwood	---	---	
						Bitternut hickory	---	---	
						Swamp white oak	---	---	
						Quaking aspen	---	---	
						Paper birch	---	---	
78 Olentangy	4W	Slight	Severe	Severe	Severe	Red maple	46	30	
						Silver maple	---	---	
						Northern white-cedar	---	---	
						Black ash	---	---	

* Cubic feet per acre per year.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
3A----------------- Shebeon	---	Lilac, silky dogwood, American cranberrybush, nannyberry viburnum, Roselow sargent crabapple.	Northern white-cedar, white spruce, Siberian crabapple.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
4B----------------- Covert	---	Lilac, American cranberrybush, Amur privet, Amur maple, silky dogwood.	White spruce, northern white-cedar.	Red maple, eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
6A*:					
Tappan-----------	---	Siberian peashrub, nannyberry viburnum, silky dogwood, lilac, American cranberrybush.	Northern white-cedar, eastern redcedar, green ash, Siberian crabapple, white spruce.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
Avoca------------	---	Silky dogwood, American cranberrybush, Tatarian honeysuckle, late lilac.	White spruce, northern white-cedar, Austrian pine, eastern white pine.	Green ash, Norway spruce.	Imperial Carolina poplar.
8A*:					
Tappan-----------	---	Siberian peashrub, nannyberry viburnum, silky dogwood, lilac, American cranberrybush.	Northern white-cedar, eastern redcedar, green ash, Siberian crabapple, white spruce.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
Londo------------	---	Amur privet, silky dogwood, lilac, American cranberrybush, Amur maple.	White spruce, northern white-cedar.	Norway spruce, green ash, red maple, eastern white pine.	Imperial Carolina poplar.
10B---------------- Pipestone	---	Lilac, Amur maple, Amur privet, silky dogwood, American cranberrybush.	Northern white-cedar, white spruce.	Red maple, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
11B---------------- Metamora	---	Silky dogwood, American cranberrybush, lilac, Amur maple, Amur privet.	Northern white-cedar, white spruce.	Eastern white pine, Norway spruce, green ash, red maple.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
12----------------- Corunna	---	Silky dogwood, American cranberrybush, lilac, nannyberry viburnum, Amur privet.	Northern white-cedar, Manchurian crabapple, white spruce.	Green ash, eastern white pine, Norway spruce.	Imperial Carolina poplar.
13A*:					
Wixom------------	---	Silky dogwood, lilac, Amur privet, American cranberrybush, Amur maple.	White spruce, northern white-cedar.	Eastern white pine, Norway spruce, green ash, red maple.	Imperial Carolina poplar.
Belleville-------	---	Silky dogwood, Amur privet, nannyberry viburnum, lilac, American cranberrybush.	White spruce, northern white-cedar, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
14A---------------- Avoca	---	Silky dogwood, American cranberrybush, Tatarian honeysuckle, late lilac.	White spruce, northern white-cedar, Austrian pine, eastern white pine.	Norway spruce, green ash.	Imperial Carolina poplar.
18----------------- Essexville	---	Amur privet, hawthorn, silky dogwood.	Eastern white pine, tamarack, northern white-cedar.	Norway spruce-----	---
19A---------------- Wasepi	---	Amur maple, Amur privet, silky dogwood, American cranberrybush, lilac.	Northern white-cedar, white spruce.	Eastern white pine, green ash, Norway spruce, red maple.	Imperial Carolina poplar.
20B*:					
Guelph-----------	---	American cranberrybush, nannyberry viburnum, Amur maple, lilac, silky dogwood.	White spruce, northern white-cedar, Manchurian crabapple.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
Londo------------	---	Amur privet, silky dogwood, lilac, American cranberrybush, Amur maple.	White spruce, northern white-cedar.	Norway spruce, green ash, red maple, eastern white pine.	Imperial Carolina poplar.
20C, 20D2--------- Guelph	---	American cranberrybush, lilac, silky dogwood.	White spruce, Manchurian crabapple, Amur maple, nannyberry viburnum, northern white-cedar.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
21B--------------- Wixom	---	Silky dogwood, lilac, Amur privet, American cranberrybush, Amur maple.	White spruce, northern white-cedar.	Eastern white pine, Norway spruce, green ash, red maple.	Imperial Carolina poplar.
25A--------------- Londo	---	Amur privet, silky dogwood, lilac, American cranberrybush, Amur maple.	White spruce, northern white-cedar.	Norway spruce, green ash, red maple, eastern white pine.	Imperial Carolina poplar.
26B--------------- Perrin	---	Arrowwood, silky dogwood, Tatarian honeysuckle, autumn-olive, Amur privet, lilac, nannyberry viburnum.	White spruce------	Eastern white pine, red pine, Norway spruce, Austrian pine.	Imperial Carolina poplar.
27B, 27C---------- Boyer	---	American cranberrybush, Siberian peashrub, nannyberry viburnum, lilac, silky dogwood, eastern redcedar.	Red pine, jack pine, green ash.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
28B*:					
Marlette----------	---	American cranberrybush, common ninebark, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
Capac-------------	---	Silky dogwood, American cranberrybush, Amur privet, Amur maple, lilac.	White spruce, northern white-cedar.	Eastern white pine, red maple, Norway spruce, green ash.	Imperial Carolina poplar.
28C, 28D, 28E----- Marlette	---	American cranberrybush, common ninebark, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
29B--------------- Metea	---	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
30B, 30C, 30D, 30E-------------- Spinks	Manyflower cotoneaster.	American cranberrybush, silky dogwood, eastern redcedar, lilac, Siberian peashrub.	Red pine, white spruce, jack pine.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
32B. Thetford	---	Silky dogwood, lilac, Amur maple, American cranberrybush, Amur privet.	White spruce, northern white-cedar.	Norway spruce, eastern white pine, red maple, green ash.	Imperial Carolina poplar.
33. Granby					
35. Wolcott	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, Washington hawthorn.	Eastern white pine	Imperial Carolina poplar.
36. Tappan	---	Siberian peashrub, nannyberry viburnum, silky dogwood, lilac, American cranberrybush.	Northern white-cedar, eastern redcedar, Siberian crabapple, white spruce.	Eastern white pine, green ash.	Imperial Carolina poplar.
37. Adrian	---	Silky dogwood, common ninebark, Amur privet, American cranberrybush, late lilac, Japanese tree lilac, nannyberry viburnum.	Northern white-cedar.	Eastern white pine, Siberian crabapple, green ash.	Imperial Carolina poplar.
38. Tobico	---	Silky dogwood, American cranberrybush, Amur privet, nannyberry viburnum, lilac.	Northern white-cedar, white spruce, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
39B. Ottokee	---	Common ninebark, silky dogwood, Roselow sargent crabapple, lilac, American cranberrybush, Amur privet, nannyberry viburnum.	White spruce	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
40B, 40C. Chelsea	Siberian peashrub, lilac.	Eastern redcedar, Tatarian honeysuckle.	Red pine, jack pine, Austrian pine.	Eastern white pine	---
42. Gilford	---	Silky dogwood, American cranberrybush, Amur privet, lilac, nannyberry viburnum.	Northern white-cedar, white spruce, Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
45 Houghton	---	Silky dogwood, late lilac, Amur privet, common ninebark, nannyberry viburnum.	Japanese tree lilac, northern white-cedar.	Black willow, green ash, Siberian crabapple.	Imperial Carolina poplar.
52A Landes	---	Tatarian honeysuckle, redosier dogwood, lilac.	Amur maple, northern white-cedar, blue spruce, white spruce.	Green ash, eastern white pine, Austrian pine.	Imperial Carolina poplar.
53 Sloan	Vanhoutte spirea	Green ash, silky dogwood, Amur privet, white spruce, Tatarian honeysuckle, American cranberrybush.	Northern white-cedar, Manchurian crabapple.	Golden willow	Imperial Carolina poplar.
54B Capac	---	Silky dogwood, American cranberrybush, Amur privet, Amur maple, lilac.	White spruce, northern white-cedar.	Eastern white pine, red maple, Norway spruce, green ash.	Imperial Carolina poplar.
55. Cohoctah					
56 Edwards	---	Amur privet, nannyberry viburnum, American cranberrybush, silky dogwood, common ninebark, Amur maple.	Manchurian crabapple, northern white-cedar.	White spruce, green ash, black willow.	Imperial Carolina poplar.
57 Palms	Vanhoutte spirea	Silky dogwood, common ninebark, nannyberry viburnum, American cranberrybush.	Northern white-cedar, Manchurian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
58 Thomas	---	Common ninebark, Amur privet, silky dogwood, American cranberrybush, nannyberry viburnum.	Northern white-cedar, white spruce, Manchurian crabapple.	Green ash, eastern white pine, Norway spruce.	Imperial Carolina poplar.
59 Pella	---	Silky dogwood, redosier dogwood, common ninebark, nannyberry viburnum, American cranberrybush, northern white-cedar.	Balsam fir, white spruce.	Green ash, white ash, red maple.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
62A: Sanilac	---	Lilac, nannyberry viburnum.	White spruce, northern white-cedar, Siberian crabapple, eastern redcedar, white spruce.	Eastern white pine, red pine, green ash.	Imperial Carolina poplar.
63: Bach	---	Silky dogwood, lilac, nannyberry viburnum, American cranberrybush, common ninebark.	Green ash, northern white-cedar, white spruce, eastern redcedar, Siberian crabapple.	Eastern white pine	Imperial Carolina poplar.
64*:					
Tappan	---	Siberian peashrub, nannyberry viburnum, silky dogwood, lilac, American cranberrybush.	Northern white-cedar, eastern redcedar, green ash, Siberian crabapple, white spruce.	Eastern white pine	Imperial Carolina poplar.
Lenawee Variant	---	Late lilac, whitebelle honeysuckle, silky dogwood.	Northern white-cedar, Austrian pine, green ash.	Eastern white pine	Imperial Carolina poplar.
65B: Fulton	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Austrian pine	Eastern white pine, green ash.	---
66: Latty	---	Amur privet, Siberian crabapple, silky dogwood.	Northern white-cedar, black willow.	Eastern white pine, Norway spruce.	---
67B: Pipestone	Vanhoutte spirea	Eastern redcedar, American cranberrybush, silky dogwood.	White spruce, northern white-cedar, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
69*:					
Edwards	---	Amur privet, nannyberry viburnum, American cranberrybush, silky dogwood, common ninebark, Amur maple.	Manchurian crabapple, northern white-cedar.	White spruce, green ash, black willow.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
69*: Adrian	---	Silky dogwood, common ninebark, Amur privet, American cranberrybush, late lilac, Japanese tree lilac, nannyberry viburnum.	Northern white-cedar.	Eastern white pine, Siberian crabapple, green ash.	Imperial Carolina poplar.
71A Rapson	---	Amur maple, silky dogwood, American cranberrybush, lilac, Amur privet.	White spruce, northern white-cedar.	Green ash, eastern white pine, Norway spruce, red maple.	Imperial Carolina poplar.
75. Aquents					
76*. Pits					
77*: Aquents.					
Psamments.					
78 Olentangy	---	Silky dogwood, Tatarian honeysuckle, American cranberrybush.	Norway spruce	Northern white-cedar, eastern white pine, Austrian pine.	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
3A: Shebeon	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
4B: Covert	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
6A*:					
Tappan	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Avoca	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
8A*:					
Tappan	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Londo	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
10B: Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
11B: Metamora	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
12: Corunna	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
13A*:					
Wixom	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Belleville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
14A: Avoca	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
18: Essexville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
19A: Wasepi	Severe: wetness.	Moderate: wetness, small stones.	Severe: small stones, wetness.	Moderate: wetness.	Moderate: wetness, droughty.
20B*:					
Guelph	Slight	Slight	Moderate: slope.	Slight	Slight.
Londo	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
20C Guelph	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
20D2 Guelph	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
21B Wixom	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
25A Londo	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
26B Perrin	Moderate: wetness.	Moderate: wetness.	Moderate: small stones.	Slight	Moderate: droughty.
27B Boyer	Slight	Slight	Moderate: slope.	Slight	Slight.
27C Boyer	Slight	Slight	Severe: slope.	Slight	Slight.
28B*:					
Marlette	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Capac	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
28C Marlette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
28D, 28E Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
29B Metea	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
30B Spinks	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
30C Spinks	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
30D, 30E Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
32B Thetford	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
33 Granby	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
35 Wolcott	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
36 Tappan	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
37 Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
38 Tobico	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
39B Ottokee	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Moderate: droughty.
40B Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
40C Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: too sandy, slope.	Severe: too sandy.	Moderate: slope, droughty.
42 Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
45 Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
52A Landes	Severe: flooding.	Slight	Slight	Slight	Moderate: droughty, flooding.
53 Sloan	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
54B Capac	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
55 Cohoctah	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: flooding, wetness.
56 Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
57 Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
58 Thomas	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
59 Pella	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
62A Sanilac	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
63 Bach	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
64*:					
Tappan	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Lenawee Variant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
65B Fulton	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
66 Latty	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
67B Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness, droughty.
69*:					
Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
71A Rapson	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
75*. Aquents					
76*. Pits					
77*:					
Aquents.					
Psamments.					
78 Olentangy	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
3A: Shebeon	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
4B: Covert	Poor	Poor	Fair	Good	Good	Poor	Poor	Poor	Good	Poor.
6A*:										
Tappan	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Avoca	Poor	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
8A*:										
Tappan	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
10B: Pipestone	Poor	Poor	Fair	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
11B: Metamora	Fair	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Very poor.
12: Corunna	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
13A*:										
Wixom	Poor	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Belleville	Poor	Fair	Fair	Poor	Poor	Fair	Good	Fair	Poor	Fair.
14A: Avoca	Poor	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
18: Essexville	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Fair.
19A: Wasepi	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
20B*:										
Guelph	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
20C: Guelph	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
20D2: Guelph	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
21B: Wixom	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
25A: Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
26B Perrin	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Poor.
27B Boyer	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
27C Boyer	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
28B*:										
Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Capac	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor.
28C Marlette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
28D, 28E Marlette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
29B Metea	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
30B Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
30C, 30D, 30E Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
32B Thetford	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
33 Granby	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Poor	Good.
35 Wolcott	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
36 Tappan	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
37 Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
38 Tobico	Very poor.	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair.
39B Ottokee	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
40B Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
40C Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
42 Gilford	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
45----------------- Houghton	Fair	Poor	Poor	Fair	Fair	Good	Good	Poor	Poor	Good.
52A---------------- Landes	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
53----------------- Sloan	Fair	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good.
54B---------------- Capac	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor.
55----------------- Cohoctah	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
56----------------- Edwards	Very poor.	Poor	Poor	Fair	Poor	Good	Good	Poor	Fair	Good.
57----------------- Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
58----------------- Thomas	Fair	Good	Poor	Good	Good	Good	Good	Fair	Good	Good.
59----------------- Pella	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
62A---------------- Sanilac	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
63----------------- Bach	Good	Good	Poor	Good	Fair	Good	Good	Good	Good	Good.
64*:										
Tappan------------	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Lenawee Variant---	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Poor	Good.
65B---------------- Fulton	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
66----------------- Latty	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
67B---------------- Pipestone	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
69*:										
Edwards-----------	Very poor.	Poor	Poor	Fair	Poor	Good	Good	Poor	Fair	Good.
Adrian------------	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
71A---------------- Rapson	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Fair	Fair.
75. Aquents										
76*. Pits										

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
77*:										
Aquents.										
Psamments.										
78----------------- Olentangy	Poor	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
3A----------------- Shebeon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
4B----------------- Covert	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
6A*:						
Tappan-----------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Avoca------------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
8A*:						
Tappan-----------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Londo------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
10B---------------- Pipestone	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
11B---------------- Metamora	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
12----------------- Corunna	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
13A*:						
Wixom------------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Belleville-------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
14A---------------- Avoca	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
18----------------- Essexville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
19A----------------- Wasepi	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
20B*:						
Guelph------------	Moderate: wetness.	Slight----------	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Slight.
Londo-------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
20C----------------- Guelph	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
20D2---------------- Guelph	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
21B----------------- Wixom	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
25A----------------- Londo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
26B----------------- Perrin	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: droughty.
27B----------------- Boyer	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
27C----------------- Boyer	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
28B*:						
Marlette----------	Slight----------	Slight----------	Slight----------	Moderate: slope.	Severe: low strength.	Slight.
Capac-------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
28C----------------- Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
28D, 28E----------- Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
29B----------------- Metea	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: frost action.	Moderate: droughty.
30B----------------- Spinks	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: droughty.
30C----------------- Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
30D, 30E----------- Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
32B-------------- Thetford	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
33--------------- Granby	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
35--------------- Wolcott	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
36--------------- Tappan	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
37--------------- Adrian	Severe: ponding, cutbanks cave, excess humus.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
38--------------- Tobico	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
39B-------------- Ottokee	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
40B-------------- Chelsea	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
40C-------------- Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.
42--------------- Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
45--------------- Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
52A-------------- Landes	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
53--------------- Sloan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
54B-------------- Capac	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
55----------------- Cohoctah	Severe: wetness, cutbanks cave.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: flooding, frost action, wetness.	Severe: flooding, wetness.
56----------------- Edwards	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.
57----------------- Palms	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
58----------------- Thomas	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding, excess humus.
59----------------- Pella	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
62A---------------- Sanilac	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
63----------------- Bach	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
64*:						
Tappan------------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Lenawee Variant--	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
65B---------------- Fulton	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
66----------------- Latty	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding, low strength.	Severe: ponding.
67B---------------- Pipestone	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
69*:						
Edwards-----------	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
69*:						
Adrian	Severe: ponding, cutbanks cave, excess humus.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
71A Rapson	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
75. Aquents						
76*. Pits						
77*:						
Aquents.						
Psamments.						
78 Olentangy	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: low strength, ponding, frost action.	Severe: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "poor," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
3A Shebeon	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
4B Covert	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
6A*:					
Tappan	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Avoca	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
8A*:					
Tappan	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
10B Pipestone	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
11B Metamora	Severe: percs slowly, wetness.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
12 Corunna	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
13A*:					
Wixom	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
Belleville	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
14A Avoca	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
18----------------- Essexville	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
19A---------------- Wasepi	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
20B*:					
Guelph-------------	Severe: wetness.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
Londo--------------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
20C---------------- Guelph	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
20D2--------------- Guelph	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
21B---------------- Wixom	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
25A---------------- Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
26B---------------- Perrin	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
27B, 27C----------- Boyer	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
28B*:					
Marlette-----------	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
Capac--------------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
28C---------------- Marlette	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
28D, 28E----------- Marlette	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
29B----------------- Metea	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
30B----------------- Spinks	Slight-----------	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
30C----------------- Spinks	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
30D, 30E------------ Spinks	Severe: slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
32B----------------- Thetford	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
33------------------ Granby	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
35------------------ Wolcott	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
36------------------ Tappan	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
37------------------ Adrian	Severe: ponding, poor filter.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
38------------------ Tobico	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
39B----------------- Ottokee	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy.
40B----------------- Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
40C----------------- Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
42------------------ Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
45----------------- Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
52A---------------- Landes	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Poor: seepage, too sandy.
53----------------- Sloan	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
54B---------------- Capac	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
55----------------- Cohoctah	Severe: wetness, flooding, poor filter.	Severe: wetness, flooding, seepage.	Severe: wetness, flooding, seepage.	Severe: wetness, flooding, seepage.	Poor: wetness, thin layer.
56----------------- Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.
57----------------- Palms	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
58----------------- Thomas	Severe: ponding, percs slowly.	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
59----------------- Pella	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
62A---------------- Sanilac	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
63----------------- Bach	Severe: ponding.	Severe: ponding.	Severe: ponding, too sandy.	Severe: ponding.	Poor: ponding.
64*:					
Tappan-------------	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Lenawee Variant----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding.
65B---------------- Fulton	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
66------------------- Latty	Severe: percs slowly, ponding.	Slight-----------	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
67B----------------- Pipestone	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
69*:					
Edwards------------	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Adrian-------------	Severe: ponding, poor filter.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
71A----------------- Rapson	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: wetness.
75. Aquents					
76*. Pits					
77*:					
Aquents.					
Psamments.					
78------------------ Olentangy	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: hard to pack, ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
3A Shebeon	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
4B Covert	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
6A*:				
Tappan	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Avoca	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
8A*:				
Tappan	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Londo	Fair: wetness, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
10B Pipestone	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
11B Metamora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
12 Corunna	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
13A*:				
Wixom	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Belleville	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
14A Avoca	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
18 Essexville	Poor: thin layer, wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: wetness.
19A Wasepi	Fair: wetness.	Probable	Probable	Poor: area reclaim.
20B*:				
Guelph	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
20B*:				
Londo	Fair: wetness, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
20C Guelph	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
20D2 Guelph	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
21B Wixom	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
25A Londo	Fair: wetness, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
26B Perrin	Fair: wetness.	Probable	Probable	Poor: area reclaim.
27B, 27C Boyer	Good	Probable	Probable	Poor: area reclaim.
28B*:				
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Capac	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
28C Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
28D, 28E Marlette	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
29B Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy, area reclaim.
30B Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
30C Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
30D, 30E Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
32B Thetford	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy, small stones.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
33 Granby	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
35 Wolcott	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
36 Tappan	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
37 Adrian	Poor: wetness, low strength.	Probable	Improbable: too sandy.	Poor: wetness, excess humus.
38 Tobico	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
39B Ottokee	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
40B, 40C Chelsea	Good	Probable	Improbable: too sandy.	Poor: too sandy.
42 Gilford	Poor: wetness.	Probable	Probable	Poor: wetness, area reclaim.
45 Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
52A Landes	Good	Probable	Improbable: too sandy.	Poor: thin layer.
53 Sloan	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
54B Capac	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
55 Cohoctah	Poor: wetness.	Probable	Probable	Poor: wetness, area reclaim, small stones.
56 Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
57 Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
58 Thomas	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
59 Pella	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
62A Sanilac	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
63-------------------- Bach	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
64*:				
Tappan---------------	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Lenawee Variant------	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
65B------------------ Fulton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
66------------------- Latty	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
67B------------------ Pipestone	Poor: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, wetness.
69*:				
Edwards--------------	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
Adrian---------------	Poor: wetness, low strength.	Probable-------------	Improbable: too sandy.	Poor: wetness, excess humus.
71A------------------ Rapson	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
75. Aquents				
76*. Pits				
77*:				
Aquents.				
Psamments.				
78------------------- Olentangy	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "moderate" and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
3A: Shebeon	Severe: piping.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, rooting depth.
4B: Covert	Severe: seepage, piping.	Severe: cutbanks cave.	Slope, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
6A*:						
Tappan	Severe: piping, wetness.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, rooting depth, percs slowly.
Avoca	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Favorable	Wetness, droughty, fast intake.	Wetness, soil blowing.	Wetness, droughty.
8A*:						
Tappan	Severe: piping, wetness.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, rooting depth, percs slowly.
Londo	Severe: wetness.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.
10B: Pipestone	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
11B: Metamora	Severe: wetness, piping.	Severe: slow refill.	Frost action	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
12: Corunna	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Erodes easily, ponding, too sandy.	Wetness, erodes easily.
13A*:						
Wixom	Severe: piping, wetness.	Severe: no water.	Favorable	Wetness, droughty, fast intake.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, droughty.
Belleville	Severe: ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Ponding, droughty, fast intake.	Ponding, soil blowing.	Wetness, droughty.
14A: Avoca	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Favorable	Wetness, droughty, fast intake.	Wetness, soil blowing.	Wetness, droughty.
18: Essexville	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
19A: Wasepi	Severe: seepage, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
20B*:						
Guelph	Severe: piping.	Severe: no water.	Slope	Wetness, slope.	Wetness	Favorable.
Londo	Severe: wetness.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.
20C, 20D2: Guelph	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope	Slope.
21B: Wixom	Severe: piping, wetness.	Severe: no water.	Favorable	Wetness, droughty, fast intake.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, droughty.
25A: Londo	Severe: wetness.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.
26B: Perrin	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
27B, 27C: Boyer	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, soil blowing.	Too sandy	Favorable.
28B*:						
Marlette	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
Capac	Severe: piping, wetness.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.
28C, 28D, 28E: Marlette	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, soil blowing.	Slope.
29B: Metea	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
30B: Spinks	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
30C, 30D, 30E: Spinks	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
32B: Thetford	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
33: Granby	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
35. Wolcott	Severe: ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding	Erodes easily, ponding.	Wetness, erodes easily.
36. Tappan	Severe: piping, wetness.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, rooting depth, percs slowly.
37. Adrian	Severe: seepage, ponding, excess humus.	Severe: slow refill, cutbanks cave.	Ponding, frost action, subsides.	Ponding, soil blowing.	Ponding, soil blowing, too sandy.	Wetness.
38. Tobico	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding	Ponding, too sandy.	Wetness, droughty.
39B. Ottokee	Severe: piping.	Severe: cutbanks cave.	Slope, cutbanks cave.	Fast intake, wetness, droughty.	Too sandy, soil blowing, wetness.	Droughty.
40B. Chelsea	Severe: piping, seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
40C. Chelsea	Severe: piping, seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
42. Gilford	Severe: seepage, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
45. Houghton	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowing.	Wetness.
52A. Landes	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Droughty	Too sandy, soil blowing.	Droughty.
53. Sloan	Severe: piping, wetness.	Severe: slow refill.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
54B. Capac	Severe: piping, wetness.	Severe: slow refill.	Slope, frost action.	Wetness, slope.	Wetness	Wetness.
55. Cohoctah	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
56. Edwards	Severe: ponding.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
57. Palms	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
58---------------- Thomas	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing.	Wetness, rooting depth, percs slowly.
59---------------- Pella	Severe: piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
62A--------------- Sanilac	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action, cutbanks cave.	Wetness--------	Erodes easily, wetness.	Wetness, erodes easily.
63---------------- Bach	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, rooting depth.	Ponding, soil blowing.	Wetness, rooting depth.
64*:						
Tappan-----------	Severe: piping, wetness.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, rooting depth, percs slowly.
Lenawee Variant--	Severe: piping, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, droughty, percs slowly.	Ponding, percs slowly.	Wetness, droughty, rooting depth.
65B--------------- Fulton	Moderate: wetness, hard to pack.	Severe: no water.	Percs slowly---	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
66---------------- Latty	Severe: hard to pack, ponding.	Severe: no water.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
67B--------------- Pipestone	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
69*:						
Edwards----------	Severe: ponding.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
Adrian-----------	Severe: seepage, ponding, excess humus.	Severe: slow refill, cutbanks cave.	Ponding, frost action, subsides.	Ponding, soil blowing.	Ponding, soil blowing, too sandy.	Wetness.
71A--------------- Rapson	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, droughty.
75. Aquents						
76*. Pits						
77*: Aquents.						

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
77*: Psamments.						
78----------------- Olentangy	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding, percs slowly.	Ponding---------	Wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
3A Shebeon	0-9	Loam	ML	A-4	0-10	85-100	80-95	70-90	50-75	20-35	NP-10
	9-17	Loam, clay loam	CL-ML, CL	A-4, A-6	0-10	85-100	80-95	65-90	50-80	20-40	4-23
	17-48	Sandy loam, loam	CL-ML, SC, CL, SM-SC	A-4, A-6	0-10	85-100	80-95	65-90	35-75	15-25	5-12
	48-60	Sandy loam, loam	CL-ML, SC, CL, SM-SC	A-4, A-6	0-10	85-100	80-95	65-90	35-75	15-25	5-12
4B Covert	0-7	Sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	7-41	Sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
	41-60	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
6A*:											
Tappan	0-11	Loam	CL, ML, CL-ML	A-4, A-6	0-5	90-100	90-95	65-95	50-80	20-35	3-15
	11-19	Loam, clay loam	CL	A-6	0-5	90-100	90-95	85-95	55-80	20-40	10-25
	19-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	90-100	90-95	85-95	55-75	20-35	5-15
Avoca	0-11	Loamy sand, loamy fine sand.	SM	A-2-4	0	100	95-100	50-75	15-35	<20	NP-4
	11-20	Fine sand, sand, loamy fine sand.	SM, SP-SM	A-1, A-2-4, A-3	1-5	95-100	85-95	40-70	5-25	<20	NP-4
	20-60	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	90-95	85-90	75-90	50-85	15-36	4-18
8A*:											
Tappan	0-11	Loam	CL, ML, CL-ML	A-4, A-6	0-5	90-100	90-95	65-95	50-80	20-35	3-15
	11-19	Loam, clay loam	CL	A-6	0-5	90-100	90-95	85-95	55-80	20-40	10-25
	19-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	90-100	90-95	85-95	55-75	20-35	5-15
Londo	0-10	Loam	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	10-20	Clay loam, loam	CL	A-6	0	95-100	90-100	85-95	60-80	30-40	11-20
	20-60	Loam, clay loam	CL	A-6	0-2	90-100	85-100	80-90	55-75	30-40	10-20
10B Pipestone	0-10	Fine sand	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	10-45	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	45-60	Sand, fine sand, loamy coarse sand.	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP
11B Metamora	0-10	Sandy loam	SM, SM-SC	A-2, A-4	0-5	95-100	95-100	60-80	25-45	<25	NP-7
	10-20	Sandy loam, loamy sand.	SM, SM-SC	A-2, A-4	0-5	95-100	90-100	50-80	15-45	<25	NP-7
	20-28	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	90-100	80-100	60-85	20-45	5-25
	28-60	Clay loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	90-100	80-100	60-85	20-45	5-25

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
12 Corunna	0-10	Sandy loam	SM, ML, SC, CL	A-2, A-4	0-5	95-100	95-100	65-85	25-70	<30	NP-10
	10-33	Sandy loam, loamy sand, fine sandy loam.	SM, SC, SM-SC	A-4, A-2	0-5	95-100	95-100	50-75	15-40	<30	NP-10
	33-60	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	70-90	25-50	11-25
13A*: Wixom	0-9	Loamy fine sand	SM	A-2-4	0	95-100	95-100	50-70	15-30	---	NP
	9-28	Sandy loam, fine sand, loamy fine sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<20	NP-4
	28-60	Silty clay loam, sandy clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	51-95	20-40	5-25
Belleville	0-10	Loamy fine sand	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
	10-22	Fine sand, loamy sand, loamy fine sand.	SM	A-2	0-3	95-100	90-100	50-85	15-30	<20	NP-4
	22-60	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-3	95-100	90-100	90-100	70-90	25-50	10-25
14A Avoca	0-11	Loamy fine sand	SM	A-2-4	0	100	95-100	50-75	15-35	<20	NP-4
	11-20	Fine sand, sand, loamy fine sand.	SM, SP-SM	A-1, A-2-4, A-3	1-5	95-100	85-95	40-70	5-25	<20	NP-4
	20-60	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	90-95	85-90	75-90	50-85	15-36	4-18
18 Essexville	0-12	Loamy fine sand	SM, SM-SC	A-2, A-4	0	100	95-100	50-85	15-45	<20	NP-7
	12-30	Loamy fine sand, fine sand, sand.	SM, SM-SC, SP-SM	A-2, A-3, A-4, A-1	0	90-100	80-100	40-85	5-45	<25	NP-7
	30-60	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	95-100	90-100	80-95	55-90	20-38	8-25
19A Wasepi	0-9	Sandy loam	SM, SM-SC	A-2, A-4	0-5	85-100	70-95	60-95	25-40	<27	NP-7
	9-24	Loamy sand, sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	85-100	70-95	55-85	20-45	15-35	2-16
	24-60	Loamy sand, coarse sand, gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-10	40-80	35-70	30-60	0-10	---	NP
20B*: Guelph	0-8	Loam	ML, SM, SC, CL	A-4, A-2-4, A-6, A-2-6	0-5	95-100	90-95	55-90	25-70	20-35	2-12
	8-23	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-90	70-85	25-40	5-20
	23-60	Loam, clay loam	CL-ML, CL	A-6, A-4	0-5	95-100	85-95	75-95	55-75	20-30	4-14
Londo	0-10	Loam	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	10-20	Clay loam, loam	CL	A-6	0	95-100	90-100	85-95	60-80	30-40	11-20
	20-60	Loam, clay loam	CL	A-6	0-2	90-100	85-100	80-90	55-75	30-40	10-20

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
20C---------------- Guelph	0-8	Loam--------------	ML, SM, SC, CL	A-4, A-2, A-6	0-5	95-100	90-95	55-90	25-70	20-35	2-12
	8-20	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-90	70-85	25-40	5-20
	20-60	Loam, clay loam	CL-ML, CL	A-6, A-4	0-5	95-100	85-95	75-95	55-75	20-30	4-14
20D2-------------- Guelph	0-8	Loam--------------	ML, SM, SC, CL	A-4, A-2, A-6	0-5	95-100	90-95	55-90	25-70	20-35	2-12
	8-23	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-90	70-85	25-40	5-20
	23-60	Loam, clay loam	CL-ML, CL	A-6, A-4	0-5	95-100	85-95	75-95	55-75	20-30	4-14
21B--------------- Wixom	0-9	Loamy fine sand	SM	A-2-4	0	95-100	95-100	50-70	15-30	---	NP
	9-28	Sandy loam, fine sand, loamy fine sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<20	NP-4
	28-60	Silty clay loam, sandy clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	51-95	20-40	5-25
25A--------------- Londo	0-10	Loam--------------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	10-20	Clay loam, loam	CL	A-6	0	95-100	90-100	85-95	60-80	30-40	11-20
	20-60	Loam, clay loam	CL	A-6	0-2	90-100	85-100	80-90	55-75	30-40	10-20
26B--------------- Perrin	0-20	Loamy sand--------	SM	A-2-4, A-1-b	0-5	95-100	65-95	45-70	15-30	---	NP
	20-32	Fine sandy loam, sandy clay loam, gravelly sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	65-95	55-85	25-45	15-35	2-16
	32-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-90	35-85	30-60	0-10	---	NP
27B, 27C---------- Boyer	0-18	Sandy loam, loamy sand.	SM, SM-SC, ML, CL-ML	A-2, A-4	0-5	95-100	75-95	50-90	25-65	<25	NP-7
	18-28	Sandy loam, loam, gravelly sandy loam.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	28-60	Gravelly sand, coarse sand, gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
28B*:											
Marlette----------	0-8	Sandy loam--------	SM, SM-SC	A-4, A-2	0-5	95-100	85-95	60-70	30-40	<25	NP-7
	8-31	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	80-95	55-90	20-40	5-25
	31-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
Capac-------------	0-10	Loam--------------	CL, ML, CL-ML	A-4	0-5	95-100	90-100	80-95	60-75	<25	3-10
	10-32	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	85-100	50-80	25-40	5-20
	32-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-75	15-35	5-15
28C, 28D, 28E----- Marlette	0-8	Sandy loam--------	SM, SM-SC	A-4, A-2	0-5	95-100	85-95	60-70	30-40	<25	NP-7
	8-31	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	80-95	55-90	20-40	5-25
	31-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
29B---------------- Metea	0-12	Loamy fine sand	SM	A-2-4	0	100	100	50-80	15-35	---	NP
	12-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4, A-3	0	100	100	50-80	5-35	---	NP
	32-43	Sandy clay loam, fine sandy loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-2-4	0	95-100	95-100	55-90	15-75	<27	4-9
	43-57	Loam, clay loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	10-15
	57-60	Loam--------------	CL, CL-ML	A-4	0-3	85-95	75-95	65-90	50-75	<25	5-10
30B, 30C, 30D, 30E-------------- Spinks	0-7	Loamy fine sand	SM	A-2-4	0	100	80-100	50-90	15-30	---	NP
	7-21	Loamy sand, fine sand.	SM, SP-SM	A-2-4, A-3	0	100	80-100	50-90	5-25	---	NP
	21-60	Stratified fine sand to loamy fine sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP
32B---------------- Thetford	0-26	Loamy fine sand, fine sand.	SM	A-2, A-4	0	95-100	90-100	70-85	20-45	<20	NP-4
	26-53	Loamy fine sand, sandy loam, fine sand.	SM	A-2, A-4	0	95-100	90-100	60-80	20-40	<20	NP-4
	53-60	Very fine sand, fine sand, sand.	SM, SP, SP-SM	A-2, A-4, A-3	0	95-100	70-100	50-85	0-45	<20	NP-4
33----------------- Granby	0-11	Loamy fine sand	SM	A-2	0	100	100	50-75	15-30	---	NP
	11-40	Sand, fine sand, loamy fine sand.	SP, SP-SM, SM	A-3, A-2	0	100	95-100	50-75	0-20	---	NP
	40-60	Sand, fine sand	SP, SP-SM	A-3, A-2	0	100	95-100	50-70	0-5	---	NP
35----------------- Wolcott	0-11	Loam--------------	CL	A-4, A-6	0	100	90-100	85-100	65-90	20-30	8-14
	11-32	Clay loam, loam	CL	A-6, A-7	0	90-100	85-100	85-98	60-90	35-50	18-30
	32-60	Loam--------------	CL, CL-ML	A-4	0	90-100	80-95	80-95	55-95	20-30	4-10
36----------------- Tappan	0-11	Loam--------------	CL, ML, CL-ML	A-4, A-6	0-5	90-100	90-95	65-95	50-80	20-35	3-15
	11-19	Loam, clay loam	CL	A-6	0-5	90-100	90-95	85-95	55-80	20-40	10-25
	19-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	90-100	90-95	85-95	55-75	20-35	5-15
37----------------- Adrian	0-22	Sapric material	PT	A-8	---	---	---	---	---	---	---
	22-60	Sand, loamy fine sand, fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
38----------------- Tobico	0-12	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	90-100	60-80	5-30	<20	NP-4
	12-60	Sand, fine sand, gravelly sand.	SP-SM, SP, SM	A-1, A-2, A-3	0	75-100	70-100	35-75	0-30	---	NP
39B---------------- Ottokee	0-16	Loamy fine sand	SM	A-2	0	100	90-100	65-80	20-35	---	NP
	16-60	Loamy fine sand, fine sand, loamy sand.	SM	A-2	0	100	90-100	65-80	20-35	---	NP
40B, 40C---------- Chelsea	0-5	Fine sand---------	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	5-60	Fine sand, sand, loamy fine sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
42----------------- Gilford	0-11	Sandy loam--------	SC, SM-SC, SM	A-4, A-2-4	0	95-100	90-100	60-70	30-40	20-30	2-10
	11-29	Sandy loam, fine sandy loam.	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	25-35	20-30	NP-8
	29-60	Gravelly sand, gravelly coarse sand, fine sand.	SP, SP-SM, GP, GP-GM	A-1	0-15	40-85	35-80	20-50	3-10	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
45--------------- Houghton	0-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
52A-------------- Landes	0-12	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	95-100	85-95	20-50	<25	NP-10
	12-60	Stratified sand to silt loam.	SM, ML, SP-SM, SC	A-2, A-4	0	100	95-100	60-95	10-70	<30	NP-10
53--------------- Sloan	0-14	Loam-------------	CL, ML, CL-ML	A-6, A-4	0	100	95-100	85-100	70-95	20-40	3-15
	14-30	Silty clay loam, clay loam, loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	75-95	30-45	8-18
	30-60	Stratified gravelly sandy loam to silty clay loam.	ML, CL	A-4, A-6	0	95-100	70-100	60-95	50-90	25-40	3-15
54B-------------- Capac	0-10	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	90-100	80-95	60-75	<25	3-10
	10-32	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	85-100	50-80	25-40	5-20
	32-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-75	15-35	5-15
55--------------- Cohoctah	0-18	Sandy loam--------	ML, SM	A-4, A-2	0	100	100	65-95	30-75	20-30	NP-6
	18-57	Loam, sandy loam, gravelly sandy loam.	ML, SM, CL, SC	A-4, A-2	0	95-100	65-100	65-90	30-70	20-30	NP-10
	57-60	Sand, gravelly loamy sand, gravelly sandy loam.	SP-SM, SP, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-90	35-85	30-60	0-10	---	NP
56--------------- Edwards	0-26	Sapric material	PT	A-8	0	---	---	---	---	---	---
	26-60	Marl-------------	---	---	0	100	95-100	80-90	60-80	---	---
57--------------- Palms	0-25	Sapric material	PT	A-8	---	---	---	---	---	---	---
	25-60	Clay loam, silt loam, sand.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
58--------------- Thomas	0-12	Sapric material	PT	A-8	0	---	---	---	---	---	---
	12-30	Silty clay loam, clay loam, loam.	CL	A-6	0-15	90-95	85-95	85-95	65-95	25-40	12-25
	30-60	Silty clay loam, loam, loamy sand.	CL	A-6	0-15	90-95	85-95	80-95	80-95	25-35	12-22
59--------------- Pella	0-12	Silt loam--------	CL	A-6, A-7	0	100	95-100	90-100	85-95	30-45	10-20
	12-30	Silt loam, silty clay, clay loam.	CL	A-6, A-7	0	100	95-100	90-100	85-95	30-50	15-30
	30-60	Stratified sandy loam to silty clay loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-5	90-100	80-100	50-100	30-85	20-35	7-20
62A-------------- Sanilac	0-13	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	90-100	70-90	25-35	5-10
	13-35	Very fine sandy loam, silt loam, very fine sand.	ML, SM	A-4	0	100	100	75-95	35-60	<25	NP-4
	35-60	Stratified loamy very fine sand to silt loam.	SM, SC, ML, CL	A-4	0	100	80-100	75-95	35-60	15-30	NP-10

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
63--------------- Bach	0-14	Very fine sandy loam.	ML, SM	A-4	0	100	100	85-95	40-65	<15	NP-4
	14-60	Very fine sandy loam, silt loam, very fine sand.	ML, SM	A-2-4, A-4	0	100	80-100	70-95	25-95	<35	NP-4
64*:											
Tappan----------	0-11	Loam-------------	CL, ML, CL-ML	A-4, A-6	0-5	90-100	90-95	65-95	50-80	20-35	3-15
	11-19	Loam, clay loam	CL	A-6	0-5	90-100	90-95	85-95	55-80	20-40	10-25
	19-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	90-100	90-95	85-95	55-75	20-35	5-15
Lenawee Variant-	0-10	Silty clay loam	CL, CL-ML, ML	A-6, A-4	0-5	95-100	90-100	85-95	60-90	15-40	2-15
	10-16	Clay loam, silty clay loam, silt loam.	CL, ML	A-6, A-4	0-5	95-100	90-100	90-95	70-95	25-40	2-15
	16-52	Stratified silt loam to silty clay.	CL	A-7, A-6	0-5	95-100	90-100	90-95	80-95	25-50	10-25
	52-60	Loam, clay loam	CL, ML, CL-ML	A-4, A-6	0-5	95-100	90-95	85-95	55-75	15-35	2-15
65B-------------- Fulton	0-7	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	85-100	80-95	35-50	12-24
	7-20	Silty clay, clay loam.	CH, CL	A-7	0	100	100	90-100	85-100	40-60	18-34
	20-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	85-100	40-60	18-34
66--------------- Latty	0-10	Silty clay loam	CL	A-7	0	100	100	95-100	85-100	40-50	20-30
	10-30	Clay, silty clay	CH, CL	A-7	0	100	100	90-100	85-100	40-65	15-40
	30-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	85-100	40-65	15-40
67B-------------- Pipestone	0-18	Fine sand--------	SP-SM, SM	A-1, A-2-4, A-3	0	95-100	90-100	40-75	5-30	---	NP
	18-48	Sand, fine sand, loamy fine sand.	SP, SP-SM, SM	A-1, A-2-4, A-3	0	95-100	90-100	40-75	2-30	---	NP
	48-60	Clay loam, loam	CL, ML	A-4, A-6	0-5	90-100	90-100	75-100	50-90	25-40	3-15
69*:											
Edwards---------	0-26	Sapric material	PT	A-8	0	---	---	---	---	---	---
	26-60	Marl-------------	---	---	0	100	95-100	80-90	60-80	---	---
Adrian----------	0-22	Sapric material	PT	A-8	---	---	---	---	---	---	---
	22-60	Sand, fine sand, loamy fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
71A-------------- Rapson	0-38	Loamy fine sand	SP-SM, SM	A-2-4, A-3	0	95-100	95-100	50-75	5-25	---	NP
	38-60	Stratified very fine sand to silt loam.	ML, CL, SM, SC	A-4	0	100	100	75-90	40-80	<25	NP-10
75. Aquents											
76*. Pits											

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
77*:											
Aquents.											
Psamments.											
78--------------- Olentangy	0-10	Mucky silt loam	OL, ML	A-5	0	100	100	90-100	80-100	40-50	2-8
	10-22	Mucky silt loam, mucky silty clay loam, silt loam.	OL	A-5	0	100	100	90-100	80-100	40-50	2-8
	22-60	Silt loam, silty clay loam, clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	80-100	65-100	20-40	3-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
3A------------- Shebeon	0-9	10-24	1.40-1.70	0.6-2.0	0.15-0.22	6.6-7.8	Low----------	0.32	4	5	1-3
	9-17	18-30	1.45-1.80	0.6-2.0	0.12-0.19	6.6-7.8	Low----------	0.32			
	17-48	18-32	1.45-1.80	0.2-2.0	0.08-0.19	7.4-8.4	Low----------	0.32			
	48-60	8-18	1.70-2.10	<0.06	0.04-0.08	7.4-8.4	Low----------	0.32			
4B------------- Covert	0-7	2-10	1.25-1.55	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.15	5	1	1-2
	7-41	2-10	1.25-1.60	6.0-20	0.05-0.08	4.5-7.3	Low----------	0.15			
	41-60	0-10	1.45-1.65	6.0-20	0.04-0.07	5.1-7.3	Low----------	0.15			
6A*:											
Tappan----------	0-11	15-25	1.12-1.59	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.28	5	5	1-4
	11-19	18-30	1.48-1.80	0.2-2.0	0.14-0.19	7.9-8.4	Low----------	0.28			
	19-60	15-28	1.46-1.95	0.06-0.2	0.15-0.19	7.9-8.4	Low----------	0.28			
Avoca-----------	0-11	0-12	1.25-1.40	6.0-20	0.10-0.12	5.6-7.8	Low----------	0.17	5	2	1-4
	11-20	2-15	1.35-1.45	6.0-20	0.04-0.11	6.1-7.8	Low----------	0.17			
	20-60	18-35	1.25-1.50	0.2-0.6	0.14-0.20	7.9-8.4	Moderate-----	0.32			
8A*:											
Tappan----------	0-11	15-25	1.12-1.59	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.28	5	5	1-4
	11-19	18-30	1.48-1.80	0.2-2.0	0.14-0.19	7.9-8.4	Low----------	0.28			
	19-60	15-28	1.46-1.95	0.06-0.2	0.15-0.19	7.9-8.4	Low----------	0.28			
Londo-----------	0-10	10-18	1.40-1.70	0.6-2.0	0.18-0.24	6.1-7.8	Low----------	0.32	5	6	1-3
	10-20	20-35	1.40-1.80	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	20-60	20-32	1.45-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
10B------------- Pipestone	0-10	2-12	1.20-1.60	6.0-20	0.07-0.10	4.5-7.3	Low----------	0.15	5	1	3-4
	10-45	2-12	1.20-1.60	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.17			
	45-60	2-12	1.20-1.60	6.0-20	0.05-0.07	5.1-7.3	Low----------	0.17			
11B------------- Metamora	0-10	5-15	1.25-1.40	2.0-6.0	0.14-0.18	5.1-7.3	Low----------	0.20	5	3	1-2
	10-20	5-15	1.40-1.60	2.0-6.0	0.10-0.15	5.1-7.3	Low----------	0.20			
	20-28	18-35	1.45-1.70	0.2-0.6	0.16-0.18	6.1-7.3	Moderate-----	0.32			
	28-60	12-30	1.45-1.70	0.2-0.6	0.14-0.18	6.6-8.4	Moderate-----	0.32			
12-------------- Corunna	0-10	5-15	1.60-1.70	0.6-6.0	0.14-0.22	6.1-7.8	Low----------	0.20	4	3	1-2
	10-33	10-18	1.30-1.60	0.6-6.0	0.08-0.14	6.1-7.8	Low----------	0.20			
	33-60	18-35	1.45-1.70	0.2-0.6	0.16-0.20	7.4-8.4	Moderate-----	0.43			
13A*:											
Wixom-----------	0-9	2-12	1.20-1.60	6.0-20	0.10-0.12	5.1-6.5	Low----------	0.17	5	2	2-4
	9-28	2-14	1.40-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.15			
	28-60	18-35	1.30-1.70	0.2-0.6	0.14-0.20	6.1-7.8	Moderate-----	0.43			
Belleville------	0-10	3-12	0.90-1.60	6.0-20	0.10-0.12	6.1-7.8	Low----------	0.17	5	2	.5-3
	10-22	2-12	1.45-1.70	6.0-20	0.06-0.10	6.1-8.4	Low----------	0.17			
	22-60	25-35	1.45-1.95	0.2-0.6	0.14-0.20	7.4-8.4	Moderate-----	0.32			
14A------------- Avoca	0-11	0-12	1.25-1.40	6.0-20	0.10-0.12	5.6-7.8	Low----------	0.17	5	2	1-4
	11-20	2-15	1.35-1.45	6.0-20	0.04-0.11	6.1-7.8	Low----------	0.17			
	20-60	18-35	1.25-1.50	0.2-0.6	0.14-0.20	7.9-8.4	Moderate-----	0.32			
18-------------- Essexville	0-12	10-15	1.35-1.50	6.0-20	0.10-0.14	7.4-8.4	Low----------	0.17	5	2	4-8
	12-30	2-12	1.40-1.55	6.0-20	0.04-0.12	7.9-8.4	Low----------	0.17			
	30-60	10-35	1.45-1.65	0.2-0.6	0.12-0.20	7.9-8.4	Moderate-----	0.32			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
19A----------- Wasepi	0-9	5-15	1.25-1.40	2.0-6.0	0.13-0.15	5.6-7.3	Low----------	0.20	4	3	2-4
	9-24	10-18	1.35-1.45	2.0-6.0	0.12-0.18	5.6-7.3	Low----------	0.20			
	24-60	0-10	1.25-1.50	>20	0.02-0.04	7.4-7.8	Low----------	0.10			
20B*:											
Guelph----------	0-8	12-25	1.30-1.65	0.6-2.0	0.14-0.20	6.1-7.8	Low----------	0.32	5	5	1-3
	8-23	18-35	1.30-1.70	0.6-2.0	0.14-0.18	6.1-7.8	Low----------	0.32			
	23-60	18-32	1.30-1.70	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.32			
Londo-----------	0-10	10-18	1.40-1.70	0.6-2.0	0.18-0.24	6.1-7.8	Low----------	0.32	5	6	1-3
	10-20	20-35	1.40-1.80	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	20-60	20-32	1.45-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
20C-------------- Guelph	0-8	12-25	1.30-1.65	0.6-2.0	0.14-0.20	6.1-7.8	Low----------	0.32	5	5	1-3
	8-20	18-35	1.30-1.70	0.6-2.0	0.14-0.18	6.1-7.8	Low----------	0.32			
	20-60	18-32	1.30-1.80	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.32			
20D2------------- Guelph	0-8	12-25	1.30-1.65	0.6-2.0	0.14-0.20	6.1-7.8	Low----------	0.32	5	5	1-3
	8-23	18-35	1.30-1.70	0.6-2.0	0.14-0.18	6.1-7.8	Low----------	0.32			
	23-60	18-32	1.30-1.80	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.32			
21B-------------- Wixom	0-9	2-12	1.20-1.60	6.0-20	0.10-0.12	5.1-6.5	Low----------	0.17	5	2	2-4
	9-28	2-14	1.40-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.15			
	28-60	18-35	1.30-1.70	0.2-0.6	0.14-0.20	6.1-7.8	Moderate-----	0.43			
25A-------------- Londo	0-10	10-18	1.40-1.70	0.6-2.0	0.18-0.24	6.1-7.8	Low----------	0.32	5	6	1-3
	10-20	20-35	1.40-1.80	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	20-60	20-32	1.45-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
26B-------------- Perrin	0-20	2-12	1.15-1.60	6.0-20	0.07-0.12	5.6-7.3	Low----------	0.17	4	2	.5-3
	20-32	5-18	1.30-1.55	2.0-6.0	0.08-0.18	5.6-7.8	Low----------	0.28			
	32-60	0-10	1.20-1.50	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
27B, 27C--------- Boyer	0-18	5-15	1.15-1.60	2.0-6.0	0.10-0.15	5.6-7.3	Low----------	0.24	4	3	.5-3
	18-28	10-18	1.25-1.60	2.0-6.0	0.12-0.18	5.6-7.8	Low----------	0.24			
	28-60	0-10	1.20-1.45	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
28B*:											
Marlette--------	0-8	10-18	1.30-1.65	2.0-6.0	0.12-0.15	5.6-7.3	Low----------	0.24	5	3	1-3
	8-31	18-30	1.30-1.70	0.2-0.6	0.18-0.20	5.6-7.8	Low----------	0.32			
	31-60	15-25	1.30-1.70	0.2-0.6	0.12-0.19	7.9-8.4	Low----------	0.32			
Capac-----------	0-10	10-18	1.40-1.70	0.6-2.0	0.18-0.20	5.6-7.3	Low----------	0.32	5	5	1-3
	10-32	18-35	1.45-1.70	0.2-0.6	0.14-0.18	5.6-7.3	Low----------	0.32			
	32-60	10-35	1.50-1.70	0.2-0.6	0.14-0.16	7.4-8.4	Low----------	0.32			
28C, 28D, 28E---- Marlette	0-8	10-18	1.30-1.65	2.0-6.0	0.12-0.15	5.6-7.3	Low----------	0.24	5	3	1-3
	8-31	18-30	1.30-1.70	0.2-0.6	0.18-0.20	5.6-7.8	Low----------	0.32			
	31-60	15-25	1.30-1.70	0.2-0.6	0.12-0.19	7.9-8.4	Low----------	0.32			
29B-------------- Metea	0-12	3-8	1.55-1.65	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	.5-2
	12-32	2-10	1.65-1.80	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	32-43	12-22	1.45-1.55	0.6-2.0	0.15-0.19	5.6-6.5	Low----------	0.32			
	43-57	27-35	1.45-1.65	0.6-2.0	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	57-60	10-24	1.55-1.75	0.6-2.0	0.10-0.19	7.4-8.4	Low----------	0.32			
30B, 30C, 30D, 30E------------- Spinks	0-7	2-15	1.20-1.60	6.0-20	0.08-0.10	5.1-7.3	Low----------	0.17	5	2	2-4
	7-21	3-15	1.20-1.60	2.0-20	0.05-0.10	5.6-7.3	Low----------	0.17			
	21-60	0-15	1.20-1.50	2.0-6.0	0.04-0.08	5.6-7.8	Low----------	0.17			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
32B---------------- Thetford	0-26	2-15	1.25-1.41	2.0-6.0	0.10-0.13	5.6-7.3	Low-----------	0.17	5	2	1-4
	26-53	8-18	1.35-1.45	2.0-6.0	0.08-0.13	5.6-7.8	Low-----------	0.17			
	53-60	0-10	1.25-1.50	6.0-20	0.05-0.08	7.4-8.4	Low-----------	0.17			
33---------------- Granby	0-11	2-14	1.20-1.60	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	4-6
	11-40	0-14	1.45-1.65	6.0-20	0.05-0.12	5.6-7.8	Low-----------	0.17			
	40-60	0-10	1.45-1.65	6.0-20	0.05-0.09	6.6-8.4	Low-----------	0.17			
35---------------- Wolcott	0-11	18-26	1.30-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Moderate------	0.28	5	6	2-5
	11-32	27-35	1.55-1.65	0.6-2.0	0.15-0.19	6.1-7.3	Moderate------	0.37			
	32-60	11-25	1.50-1.65	0.6-2.0	0.17-0.19	7.4-8.4	Low-----------	0.37			
36---------------- Tappan	0-11	15-25	1.12-1.59	0.6-2.0	0.18-0.22	7.4-8.4	Low-----------	0.28	5	5	1-4
	11-19	18-30	1.48-1.80	0.2-2.0	0.14-0.19	7.9-8.4	Low-----------	0.28			
	19-60	15-28	1.46-1.95	0.06-0.2	0.15-0.19	7.9-8.4	Low-----------	0.28			
37---------------- Adrian	0-22	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	--------------	----	2	2	55-75
	22-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low-----------	----			
38---------------- Tobico	0-12	2-10	0.90-1.60	6.0-20	0.06-0.20	6.6-7.8	Low-----------	0.15	5	2	4-6
	12-60	0-10	1.45-1.70	>20	0.04-0.07	7.4-8.4	Low-----------	0.15			
39B---------------- Ottokee	0-16	2-10	1.40-1.60	6.0-20	0.07-0.11	5.6-7.3	Low-----------	0.17	5	2	.5-2
	16-60	1-12	1.50-1.70	6.0-20	0.06-0.10	5.6-7.3	Low-----------	0.17			
40B, 40C---------- Chelsea	0-5	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low-----------	0.17	5	2	.5-1
	5-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-5.5	Low-----------	0.17			
42---------------- Gilford	0-11	10-20	1.50-1.70	2.0-6.0	0.16-0.18	5.6-7.3	Low-----------	0.20	4	3	2-4
	11-29	8-17	1.60-1.80	2.0-6.0	0.10-0.14	5.6-7.3	Low-----------	0.20			
	29-60	1-5	1.70-1.90	>20	0.02-0.04	6.6-8.4	Low-----------	0.10			
45---------------- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	4.5-7.8	--------------	----	2	2	>70
52A---------------- Landes	0-12	5-20	1.40-1.60	2.0-6.0	0.10-0.18	6.1-8.4	Low-----------	0.20	5	3	1-2
	12-60	8-18	1.60-1.80	6.0-20	0.05-0.15	6.1-8.4	Low-----------	0.20			
53---------------- Sloan	0-14	15-27	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.37	5	6	3-6
	14-30	22-35	1.25-1.55	0.2-2.0	0.15-0.19	6.1-8.4	Moderate------	0.37			
	30-60	10-30	1.20-1.50	0.2-2.0	0.13-0.18	6.6-8.4	Low-----------	0.37			
54B---------------- Capac	0-10	10-18	1.40-1.70	0.6-2.0	0.18-0.20	5.6-7.3	Low-----------	0.32	5	5	1-3
	10-32	18-35	1.45-1.70	0.2-0.6	0.14-0.18	5.6-7.3	Low-----------	0.32			
	32-60	10-35	1.50-1.70	0.2-0.6	0.14-0.16	7.4-8.4	Low-----------	0.32			
55---------------- Cohoctah	0-18	5-20	1.20-1.60	2.0-6.0	0.13-0.22	6.1-7.8	Low-----------	0.28	5	3	1-4
	18-57	5-27	1.45-1.65	2.0-6.0	0.12-0.20	6.1-8.4	Low-----------	0.28			
	57-60	5-10	1.40-1.55	>20	0.02-0.07	7.9-8.4	Low-----------	0.10			
56---------------- Edwards	0-26	---	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	--------------	----	2	2	55-75
	26-60	---	---	---	---	7.4-8.4	--------------	----			
57---------------- Palms	0-25	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8	--------------	----	2	2	>75
	25-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low-----------	----			
58---------------- Thomas	0-12	---	0.30-0.55	0.2-6.0	0.35-0.45	6.6-7.8	--------------	----	2	3	55-75
	12-30	18-35	1.40-1.80	0.6-2.0	0.12-0.20	7.4-8.4	Moderate------	----			
	30-60	18-35	1.50-1.80	0.06-0.6	0.12-0.18	7.4-8.4	Moderate------	----			
59---------------- Pella	0-12	18-27	1.15-1.35	0.6-2.0	0.22-0.24	6.1-7.8	Moderate------	0.28	5	6	5-6
	12-30	27-35	1.20-1.45	0.6-2.0	0.21-0.24	6.6-7.8	Moderate------	0.28			
	30-60	15-30	1.40-1.70	0.6-2.0	0.10-0.22	7.4-8.4	Low-----------	0.28			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
62A--------------- Sanilac	0-13	3-18	1.40-1.70	0.6-2.0	0.20-0.24	6.6-8.4	Low-----------	0.37	5	4L	1-3
	13-35	0-18	1.45-1.80	0.2-2.0	0.06-0.22	7.9-8.4	Low-----------	0.37			
	35-60	0-18	1.50-1.90	0.2-2.0	0.06-0.22	7.9-8.4	Low-----------	0.37			
63--------------- Bach	0-14	2-15	1.15-1.60	2.0-6.0	0.20-0.22	6.6-8.4	Low-----------	0.28	5	3	1-4
	14-60	0-18	1.50-1.95	0.6-2.0	0.14-0.22	7.9-8.4	Low-----------	0.28			
64*:											
Tappan-----------	0-11	15-25	1.12-1.59	0.6-2.0	0.18-0.22	7.4-8.4	Low-----------	0.28	5	5	1-4
	11-19	18-30	1.48-1.80	0.2-2.0	0.14-0.19	7.9-8.4	Low-----------	0.28			
	19-60	15-28	1.46-1.95	0.06-0.2	0.15-0.19	7.9-8.4	Low-----------	0.28			
Lenawee Variant-	0-10	20-35	0.90-1.55	0.2-20	0.17-0.24	7.4-7.8	Low-----------	0.24	5	4	2-6
	10-16	20-39	1.35-1.80	0.2-0.6	0.08-0.12	7.9-8.4	Low-----------	0.32			
	16-52	20-50	1.50-1.80	0.06-0.6	0.06-0.10	7.4-8.4	Moderate-----	0.32			
	52-60	15-35	1.45-1.95	0.6-2.0	0.07-0.11	7.4-8.4	Low-----------	0.32			
65B-------------- Fulton	0-7	27-40	1.35-1.55	0.2-0.6	0.21-0.23	5.1-7.3	Moderate-----	0.43	3	7	2-3
	7-20	45-60	1.40-1.70	0.06-0.2	0.09-0.13	5.1-7.3	High----------	0.32			
	20-60	35-60	1.40-1.70	0.06-0.2	0.09-0.13	6.1-7.8	High----------	0.32			
66--------------- Latty	0-10	35-40	1.30-1.45	0.2-0.6	0.18-0.20	6.1-7.8	High----------	0.28	5	4	3-5
	10-30	45-60	1.35-1.65	0.06-0.2	0.09-0.13	6.1-7.8	High----------	0.28			
	30-60	45-60	1.45-1.60	<0.06	0.08-0.12	7.4-8.4	High----------	0.28			
67B-------------- Pipestone	0-18	2-12	1.20-1.60	6.0-20	0.06-0.10	4.5-7.3	Low-----------	0.17	5	1	3-4
	18-48	2-12	1.20-1.60	6.0-20	0.04-0.08	4.5-7.3	Low-----------	0.17			
	48-60	12-35	1.40-1.70	0.06-0.6	0.16-0.18	7.4-8.4	Low-----------	0.32			
69*:											
Edwards----------	0-26	---	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	2	2	55-75
	26-60	---	---	---	---	7.4-8.4	-------------	----			
Adrian-----------	0-22	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----	2	2	55-75
	22-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low-----------	----			
71A-------------- Rapson	0-38	2-15	1.29-1.72	6.0-20	0.06-0.12	5.6-7.8	Low-----------	0.17	5	2	2-3
	38-60	10-20	1.40-1.94	0.6-2.0	0.05-0.20	7.9-8.4	Low-----------	0.43			
75. Aquents											
76*. Pits											
77*: Aquents.											
Psamments.											
78--------------- Olentangy	0-10	20-27	0.20-0.80	0.6-2.0	0.24-0.34	3.6-7.8	Low-----------	----	---	8	15-25
	10-22	20-33	0.20-0.80	0.6-2.0	0.24-0.34	3.6-7.8	Low-----------	----			
	22-60	20-40	1.30-1.65	0.06-0.2	0.18-0.22	7.4-8.4	Low-----------	----			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "occasional," "frequent," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Total subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months			Uncoated steel	Concrete
					Ft			In			
3A---------------- Shebeon	C	None---------	---	---	1.0-2.0	Perched	Dec-May	---	High-----	High-----	Low.
4B---------------- Covert	A	None---------	---	---	2.0-3.5	Apparent	Nov-Apr	---	Low------	Low------	Moderate.
6A*:											
Tappan-----------	B/D	None---------	---	---	+1-1.0	Apparent	Oct-May	---	High-----	High-----	Low.
Avoca------------	B	None---------	---	---	0.5-1.5	Apparent	Nov-May	---	Moderate	High-----	Low.
8A*:											
Tappan-----------	B/D	None---------	---	---	+1-1.0	Apparent	Oct-May	---	High-----	High-----	Low.
Londo------------	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	High-----	High-----	Low.
10B--------------- Pipestone	B	None---------	---	---	0.5-1.5	Apparent	Oct-Jun	---	Moderate	Low------	Moderate.
11B--------------- Metamora	B	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	High-----	Moderate	Moderate.
12---------------- Corunna	B/D	None---------	---	---	+1-1.0	Apparent	Nov-May	---	High-----	High-----	Low.
13A*:											
Wixom------------	B	None---------	---	---	0.5-1.5	Perched	Nov-Jun	---	Moderate	Moderate	High.
Belleville-------	B/D	None---------	---	---	+1-1.0	Apparent	Nov-May	---	High-----	High-----	Low.
14A--------------- Avoca	B	None---------	---	---	0.5-1.5	Apparent	Nov-May	---	Moderate	High-----	Low.
18---------------- Essexville	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	---	High-----	High-----	Low.
19A--------------- Wasepi	B	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	High-----	Moderate	Low.
20B*:											
Guelph-----------	B	None---------	---	---	2.5-6.0	Perched	Dec-Apr	---	Moderate	Moderate	Low.
Londo------------	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	High-----	High-----	Low.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Total subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months			Uncoated steel	Concrete
					Ft			In			
20C, 20D2--------- Guelph	B	None---------	---	---	>6.0	---	---	---	Moderate	Moderate	Low.
21B--------------- Wixom	B	None---------	---	---	0.5-1.5	Perched	Nov-Jun	---	Moderate	Moderate	High.
25A--------------- Londo	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	High-----	High-----	Low.
26B--------------- Perrin	B	None---------	---	---	2.0-3.5	Apparent	Nov-May	---	Moderate	Low------	Moderate.
27B, 27C---------- Boyer	B	None---------	---	---	>6.0	---	---	---	Low------	Low------	Moderate.
28B*:											
Marlette----------	B	None---------	---	---	>6.0	---	---	---	Moderate	Low------	Moderate.
Capac-------------	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	High-----	High-----	Low.
28C, 28D, 28E----- Marlette	B	None---------	---	---	>6.0	---	---	---	Moderate	Low------	Moderate.
29B--------------- Metea	B	None---------	---	---	>6.0	---	---	---	Moderate	Moderate	Moderate.
30B, 30C, 30D, 30E-------------- Spinks	A	None---------	---	---	>6.0	---	---	---	Low------	Low------	Low.
32B--------------- Thetford	A	None---------	---	---	1.0-2.0	Apparent	Feb-May	---	Moderate	Low------	Moderate.
33---------------- Granby	A/D	None---------	---	---	+1-1.0	Apparent	Nov-Jun	---	Moderate	High-----	Low.
35---------------- Wolcott	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	---	High-----	High-----	Low.
36---------------- Tappan	B/D	None---------	---	---	+1-1.0	Apparent	Oct-May	---	High-----	High-----	Low.
37---------------- Adrian	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	29-33	High-----	High-----	Moderate.
38---------------- Tobico	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	---	Moderate	High-----	Low.
39B--------------- Ottokee	A	None---------	---	---	2.0-3.5	Apparent	Jan-Apr	---	Low------	Low------	Low.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Total subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months			Uncoated steel	Concrete
					Ft			In			
40B, 40C: Chelsea	A	None	---	---	>6.0	---	---	---	Low	Low	Low.
42: Gilford	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	---	High	High	Moderate.
45: Houghton	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	55-60	High	High	Moderate.
52A: Landes	B	Occasional	Brief	Jan-Jun	4.0-6.0	Apparent	Mar-May	---	Moderate	Low	Low.
53: Sloan	B/D	Occasional	Brief	Nov-Jun	0-1.0	Apparent	Nov-Jun	---	High	High	Low.
54B: Capac	C	None	---	---	1.0-2.0	Apparent	Nov-May	---	High	High	Low.
55: Cohoctah	B/D	Frequent	Long	Jan-Dec	0-1.0	Apparent	Sep-May	---	High	High	Low.
56: Edwards	B/D	None	---	---	+1-0.5	Apparent	Sep-Jun	25-30	High	High	Low.
57: Palms	A/D	None	---	---	+1-1.0	Apparent	Nov-May	25-32	High	High	Moderate.
58: Thomas	B/D	None	---	---	+1-0.5	Apparent	Nov-Jun	---	High	High	Low.
59: Pella	B/D	None	---	---	+.5-2.0	Apparent	Dec-Jun	---	High	High	Low.
62A: Sanilac	B	None	---	---	1.0-2.0	Apparent	Oct-Jun	---	High	Moderate	Low.
63: Bach	B/D	None	---	---	+1-1.0	Apparent	Sep-Jun	---	High	High	Low.
64*:											
Tappan	B/D	None	---	---	+1-1.0	Apparent	Oct-May	---	High	High	Low.
Lenawee Variant	D	None	---	---	+1-1.0	Apparent	Oct-May	---	High	High	Low.
65B: Fulton	D	None	---	---	1.0-2.5	Perched	Dec-May	---	Moderate	High	Moderate.
66: Latty	D	None	---	---	+.5-1.0	Perched	Jan-Apr	---	Moderate	High	Low.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Total subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months			Uncoated steel	Concrete
					Ft			In			
67B-------------- Pipestone	B	None--------	---	---	0.5-1.5	Apparent	Nov-May	---	Moderate	Low------	Moderate.
69*:											
Edwards----------	B/D	None--------	---	---	+1-0.5	Apparent	Sep-Jun	25-30	High-----	High-----	Low.
Adrian-----------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	29-33	High-----	High-----	Moderate.
71A-------------- Rapson	B	None--------	---	---	0.5-1.5	Apparent	Dec-May	---	Moderate	Low------	High.
75. Aquents											
76*. Pits											
77*:											
Aquents.											
Psamments.											
78--------------- Olentangy	A/D	None--------	---	---	+1-1.0	Apparent	Oct-Jul	---	High-----	High-----	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 20.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Aquents	Mixed, nonacid, mesic Aquents
Avoca	Sandy over loamy, mixed, mesic Entic Haplaquods
*Bach	Coarse-silty, mixed (calcareous), mesic Mollic Haplaquepts
Belleville	Sandy over loamy, mixed, mesic Typic Haplaquolls
*Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
Capac	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Chelsea	Mixed, mesic Alfic Udipsamments
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Corunna	Coarse-loamy, mixed, mesic Typic Haplaquolls
Covert	Sandy, mixed, mesic Entic Haplorthods
Edwards	Marly, euic, mesic Limnic Medisaprists
Essexville	Sandy over loamy, mixed (calcareous), mesic Typic Haplaquolls
Fulton	Fine, illitic, mesic Aeric Ochraqualfs
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Granby	Sandy, mixed, mesic Typic Haplaquolls
Guelph	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Houghton	Euic, mesic Typic Medisaprists
Landes	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Latty	Fine, illitic, nonacid, mesic Typic Haplaquepts
Lenawee Variant	Fine-silty, mixed, mesic Typic Calciaquolls
Londo	Fine-loamy, mixed, mesic Aeric Glossaqualfs
Marlette	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Metamora	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Metea	Loamy, mixed, mesic Arenic Hapludalfs
Olentangy	Fine-silty, mixed, mesic Histic Humaquepts
*Ottokee	Mixed, mesic Aquic Udipsamments
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Pella	Fine-silty, mixed, mesic Typic Haplaquolls
Perrin	Coarse-loamy, mixed, mesic Typic Hapludalfs
Pipestone	Sandy, mixed, mesic Entic Haplaquods
Psamments	Mixed, mesic Udipsamments
Rapson	Sandy over loamy, mixed, mesic Entic Haplaquods
Sanilac	Coarse-silty, mixed (calcareous), mesic Aeric Haplaquepts
Shebeon	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs
Tappan	Fine-loamy, mixed (calcareous), mesic Typic Haplaquolls
*Thetford	Sandy, mixed, mesic Psammaquentic Hapludalfs
Thomas	Fine-loamy, mixed (calcareous), mesic Histic Humaquepts
*Tobico	Mixed, mesic Mollic Psammaquents
Wasepi	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Wixom	Sandy over loamy, mixed, mesic Alfic Haplaquods
Wolcott	Fine-loamy, mixed, mesic Typic Haplaquolls

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