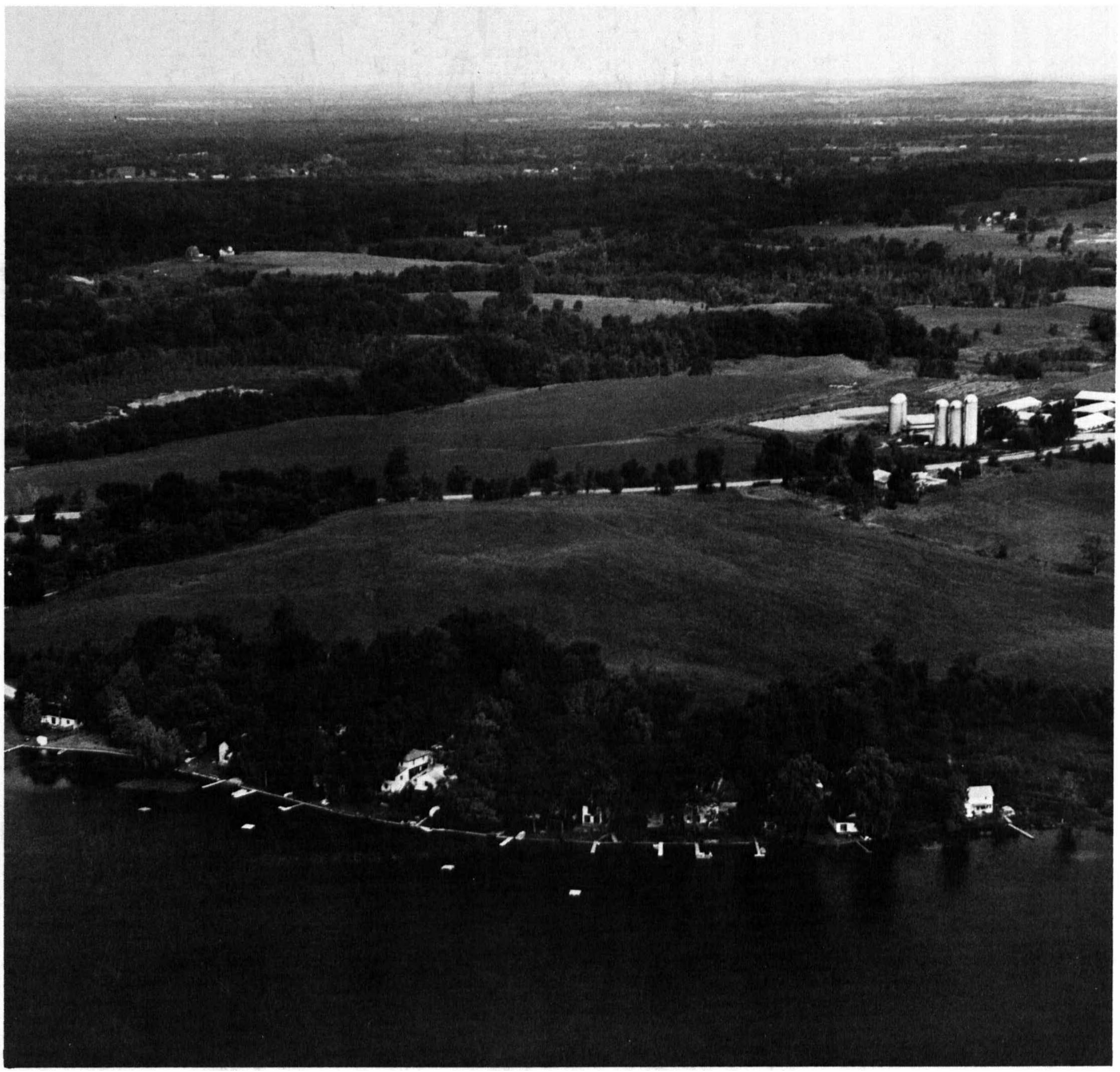
United States
Department of
Agriculture

Soil
Conservation
Service

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

Soil Survey of Barry County, Michigan



How To Use This Soil Survey

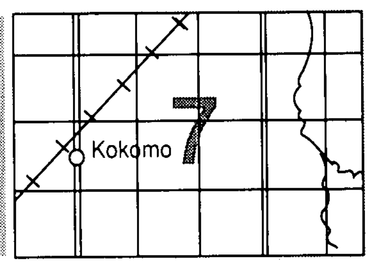
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

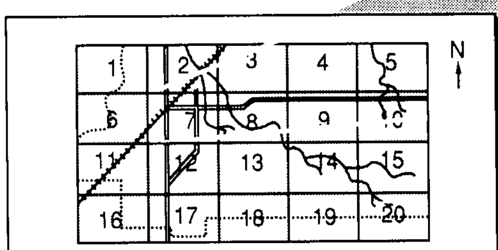
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



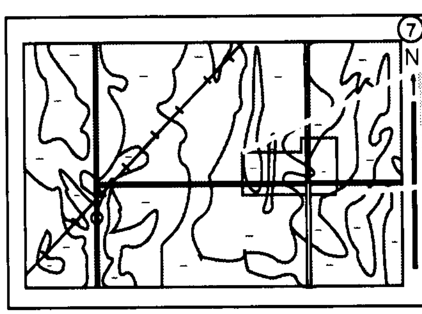
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

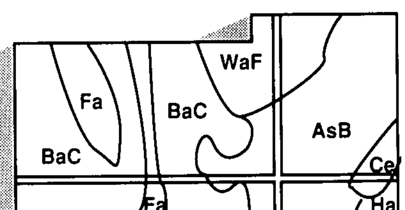


INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

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.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1988. This survey was made cooperatively by the Soil Conservation Service and the Michigan Agricultural Experiment Station, Michigan Department of Agriculture, and Michigan Technological University. It is part of the technical assistance furnished to the Barry Soil and Water Conservation District. The Barry County Board of Commissioners provided financial assistance for the survey.

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.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: An area of Marlette and Oshtemo soils. Many lakes in the county provide opportunities for recreation.

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Issued October 1990

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Barry County, Michigan. 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.

Homer R. Hilner
State Conservationist
Soil Conservation Service

Location of Barry County in Michigan.

Soil Survey of Barry County, Michigan

By Gregory F. Thoen, Soil Conservation Service

Fieldwork by Richard W. Neilson, William Perkis, and Gregory F. Thoen, Soil Conservation Service, and Karl Hausler and Mary Dugan, Michigan Department of Agriculture

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

BARRY COUNTY is in the south-central part of Michigan's Lower Peninsula. The county has an area of about 577 square miles, or 369,212 acres. The city of Hastings is the county seat and the commercial, industrial, and educational center. The population of the county in 1980 was 45,781.

About 62 percent of the land in the survey area is used for cash crops, dairying, and other farm enterprises. The chief cash crop is corn. About 31 percent of the land is woodland. About 1 percent is urban or built-up land *(16)*.

Soil scientists have determined that there are about 30 different kinds of soil in Barry County. The soils have a wide range in texture, natural drainage, slope, and other characteristics. Excessively drained and well drained soils make up about 60 percent of the survey area; moderately well drained soils, 12 percent; somewhat poorly drained, about 7 percent; poorly drained and very poorly drained, mineral soils, 5 percent; and very poorly drained, organic soils, 8 percent. The rest of the county is classified as soils at the higher categories, as miscellaneous areas, or as water areas.

This soil survey updates the survey of Barry County published in 1928 *(4)*. It provides detailed aerial photography and more interpretive information.

General Nature of the County

This section provides information about natural and cultural factors that affect land use in Barry County.

Climate

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

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

In winter, the average temperature is 24.6 degrees F and the average daily minimum temperature is 16.5 degrees. The lowest temperature on record, which occurred at Hastings on February 12, 1899, is -31 degrees. In summer, the average temperature is 69.5 degrees and the average daily maximum temperature is 82.0 degrees. The highest recorded temperature, which occurred at Hastings on July 14, 1936, is 109 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 31.23 inches. Of this, 18.95 inches, or about 60 percent, usually falls in April through September. 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 16.1 inches. The heaviest 1-day rainfall during the period of record was 5.69 inches at Hastings on August 19, 1939. Thunderstorms occur on about 38 days each year.

The average seasonal snowfall is 52.1 inches. The greatest snow depth at any one time during the period of record was 24.0 inches. On the average, 67 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year. The heaviest 1-day snowfall on record was more than 10.0 inches. The greatest monthly snowfall was 33.7 inches in January 1979. The greatest seasonal total snowfall was 83.0 inches during the winter of 1951-52, and the least seasonal total snowfall was 9.4 inches during 1948-49.

The average relative humidity in midafternoon is about 63 percent. Humidity is higher at night, and the average at dawn is about 82 percent. The sun shines 62 percent of the time possible in summer and 31 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 11.4 miles per hour, in January.

Farming

The pioneer farmers in Barry County were primarily subsistence farmers *(3)*. They sought out the easily cultivated areas first, such as Bulls Prairie in Irving Township, Scales Prairie in Thornapple Township, and the oak openings in the southern and western parts of the county. These areas were typically free of brush and were not sandy or gravelly. Around 1840, the settlers realized that the timbered lands, though requiring increased labor to clear for cultivation, were rich and productive.

The early settlers raised potatoes, wheat, and corn primarily for their own use. They generally had a cow and a few sheep. By the late 1800's, wheat, corn, and buckwheat were grown and milled for local and distant markets. Hay grown as feed for an expanding dairy industry became a major crop. Also, apples, plums, pears, and peaches were grown on many farms.

Between 1900 and 1950, the number of cattle, sheep, hogs, chickens, and turkeys increased. Corn, wheat, and oats were the major grain crops. Hay continued to be a major crop as dairying became the main source of farm income. Commercial orchards diminished to the point where they no longer were an important contributor to the county's farm economy.

Dairying continues to be the main source of farm income. Except for turkey farms, other livestock enterprises have decreased significantly in importance since 1950 *(17)*. The major crops are corn, wheat, hay, and soybeans. The minor crops include oats, dry beans, barley, and potatoes. Irrigation, drainage, and reduced tillage systems are commonly used to increase farming efficiency.

History and Development

The formation of what is now Barry County began in 1819 with the signing of the Treaty of Saginaw *(11)*. In this treaty, the Chippewa Indians ceded to the United States the territory which included what was to become the southeast portion of the county. With the signing of the Treaty of Chicago in 1821 by the Chippewa, Ottawa, and Pottawattami Indians, the land which would form the rest of the county was ceded to the United States.

In 1829, the territory was legally established as a county. At that time, however, the new county included all of what is now Allegan and Barry Counties. The following year, Amasa S. Parker established the first settlement in what is now Prairieville Township. By 1837, the population of Barry County, then recognized as Barry Township, had grown to 512. In April 1839, Barry County was officially formed. It was named after William T. Barry, Postmaster General of the United States under President Jackson. By the end of the next year, the county's population had grown to 1,200 residents. In the next 30 years, the population grew to 22,200. Hastings was established as the county seat. Major roads were constructed from Hastings to Battle Creek, Charlotte, and Grand Rapids, and the Grand River Valley Railroad was constructed.

Since 1870, the population of the county has doubled. Manufacturing has replaced agriculture and wholesale or retail trade as the primary source of employment. The old plank roads have been replaced by paved highways, which have contributed to the demise of the railroads but have made the county's recreational areas accessible to millions.

Physiography

The bedrock in Barry County consists of the eroded edges of bowllike formations that fill the Michigan basin. The bedrock is dominantly shale and sandstone and some gypsum, limestone, and dolomite *(5)*.

Overlying the bedrock is a mass of glacial drift between 150 and 400 feet thick. It is in this drift veneer that the soils in the county formed.

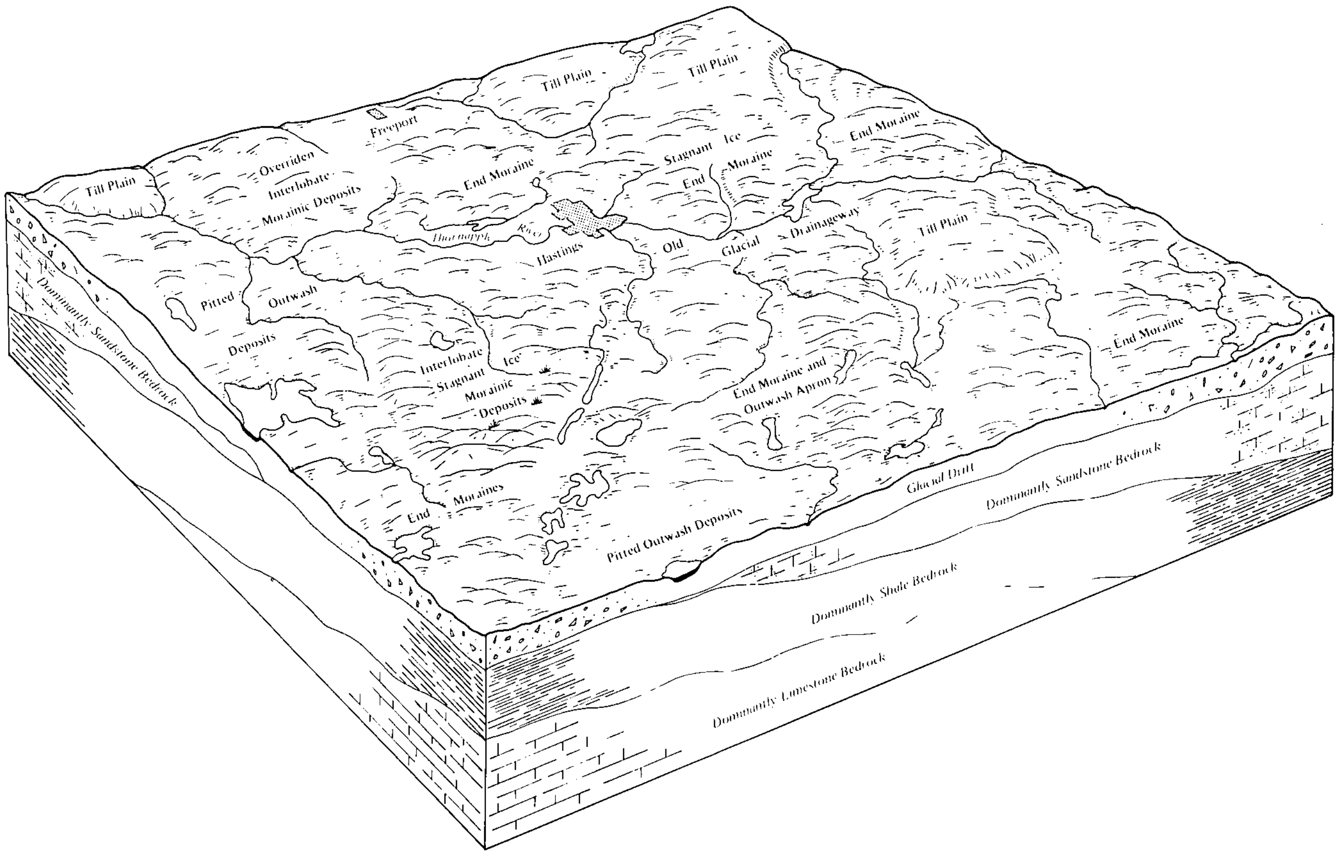

Figure 1.—Physiography of Barry County, Michigan.

The county is in five major physiographic regions (fig. 1). The first of these is an interlobate tract bounded approximately by Prairieville, Shultz, Yankee Springs, and the Thornapple Valley. In this area glacial ice from the Michigan and Saginaw lobes of the Wisconsin ice sheet came together. The resultant intermorainic tract is a very pronounced knob and basin topography with sharp, high-standing ridges and knolls. The drift in this region is dominantly coarse textured.

The next physiographic region is a morainic ridge system that is contiguous with the interlobate tract and extends to the southwest corner of the county. Two well defined morainic ridges separated by a narrow outwash plain make up this region. This physiographic region consists of material deposited by the Michigan lobe. It is characterized by conspicuous basins and sharp knolls. The landscape is much more broken on the western edge than in the other parts of the region. Many of the basins are lakes or are filled with organic deposits. The drift is a complex mix of various textures but is generally coarse textured material irregularly capped with stony, loamy till a few feet thick.

The third physiographic region is the most extensive one in the county. It consists of drift deposited by the Saginaw lobe. It extends from the northwest corner of the county to the southeast corner. The relief and complexity of the region are greatest in the westernmost part and become less pronounced to the northeast. The texture of the drift varies greatly within short distances.

The fourth physiographic region consists of till plains in the northeastern part of the county. This region is characterized by nearly level to undulating areas of loamy till deposited by the Saginaw lobe.

The last physiographic region consists of two distinct areas of generally coarse textured outwash deposits. One area includes the Thornapple Valley and extends from west of Middleville south through Gun Lake and the Gun River Plain. The other area extends from near Prairieville south and southeast in a fan shape. This region is generally a plain that is characterized by numerous basins and depressions in areas adjacent to the interlobate tract of the first physiographic region. The outwash material is about 30 to 40 feet thick *(7)*.

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; and the kinds of crops and native plants growing on the soils. 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 biological 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 a considerable degree of 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, reaction, 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 interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are 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 are 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 predict with a fairly high degree of accuracy 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 Barry 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 improvements in the classification of soils, particularly modifications or refinements in soil series concepts. Also, some differences result from variations in the intensity of mapping or in the extent of the soils within the counties.

Soil Descriptions

1. Marlette-Capac Association

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

The Marlette soils in this association are in the highest landscape positions. The Capac soils are on foot slopes, in broad areas, and in depressions on the lower parts of the landscape. Slope ranges from 0 to 12 percent.

This association makes up about 18 percent of the county. It is about 60 percent Marlette soils, 20 percent Capac soils, and 20 percent soils of minor extent (fig. 2).

The Marlette soils are nearly level to gently rolling and are well drained or moderately well drained. Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The next 12 inches is light yellowish brown, mottled, firm fine sandy loam mixed with dark yellowish brown clay loam. The subsoil is yellowish brown, mottled, firm clay loam about 10 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled loam.

The Capac soils are nearly level and gently undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The next 7 inches is dark yellowish brown, mottled, firm clay loam mixed with brown sandy loam. The subsoil is about 9 inches thick. It is yellowish brown and mottled. The upper part is firm clay loam, and the lower part is friable loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam.

Minor in this association are the poorly drained Colwood, Lenawee, and Parkhill soils. Colwood and Lenawee soils are stratified. They are slightly lower on the landscape than the Capac soils. Also, Lenawee soils contain more clay in the subsoil. Parkhill soils are not stratified. They are lower on the landscape than the Capac soils.

Most areas of this association are used for crops, including hay. Some areas are used as pasture or woodland. A few areas are idle.

The major soils are generally well suited to such crops as corn, soybeans, and winter wheat and to pasture. Water erosion, soil blowing, wetness, and tilth are the major management concerns. Grazing when the soils are too wet can cause surface compaction. Few limitations affect the use of these soils as woodland. The equipment limitation is a management concern on the Capac soils.

The well drained Marlette soils are poorly suited to septic tank absorption fields because of moderately slow permeability. They are well suited to building site development. The moderately well drained Marlette soils and the Capac soils are generally unsuited to

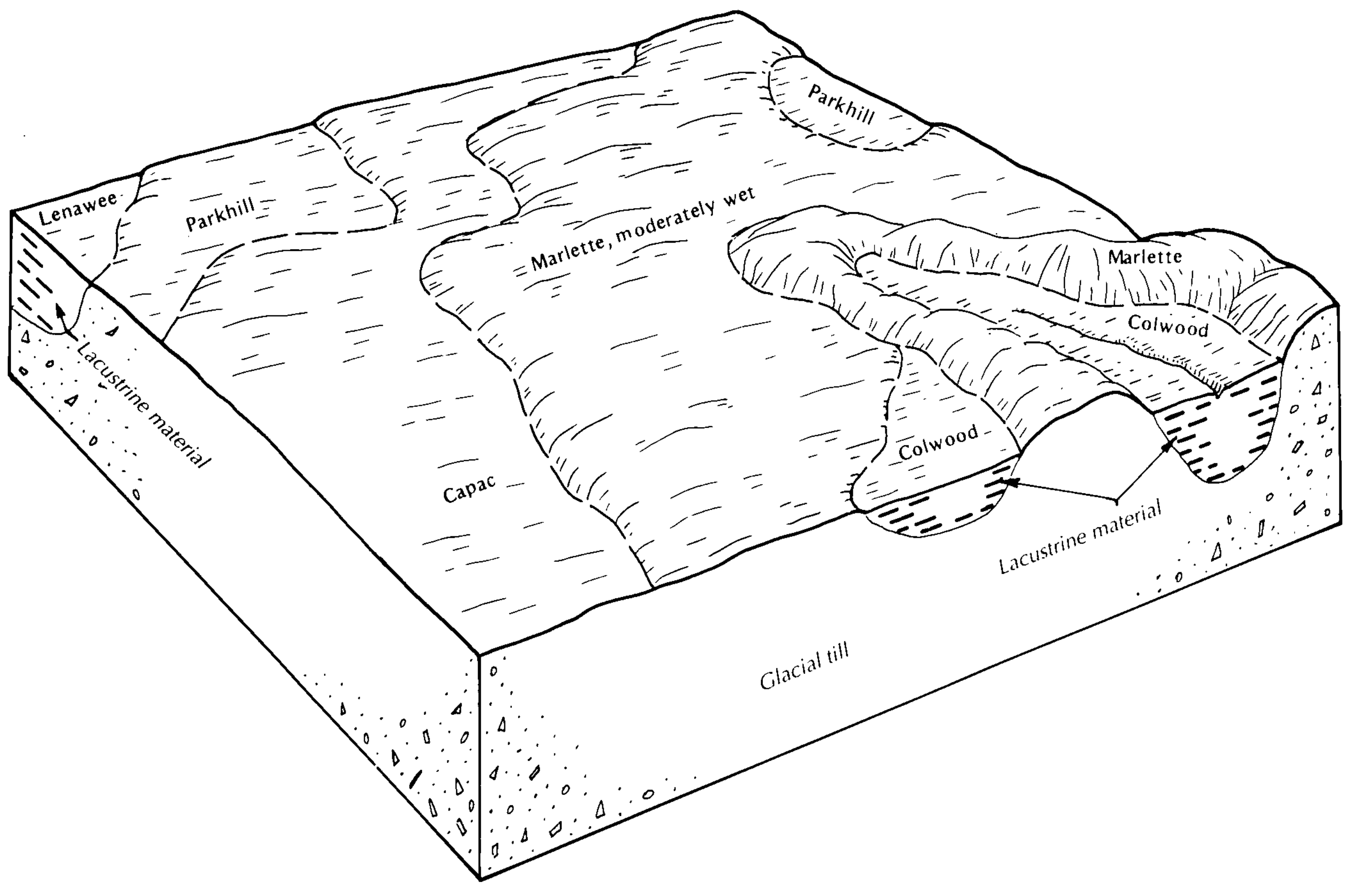

Figure 2.—Typical pattern of soils and parent material in the Marlette-Capac association.

septic tank absorption fields because of wetness and moderately slow permeability. Because of the wetness, the moderately well drained Marlette soils are only fairly well suited to building site development and the Capac soils are poorly suited.

2. Kalamazoo-Oshtemo Association

Nearly level to moderately sloping, well drained, loamy soils on outwash plains and moraines

The major soils in this association are on broad flats, low knolls, and low ridges. Slope ranges from 0 to 12 percent.

This association makes up about 7 percent of the county. It is about 65 percent Kalamazoo soils, 25 percent Oshtemo soils, and 10 percent soils of minor extent.

Typically, the surface layer of the Kalamazoo soils is dark brown loam about 10 inches thick. The subsoil is about 34 inches thick. The upper part is brown, firm sandy clay loam and gravelly sandy clay loam; the next part is brown, friable gravelly sandy loam; and the lower part is brown, very friable very gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown, stratified sand and gravel.

Typically, the surface layer of the Oshtemo soils is dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, very friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of about 80 inches is yellowish brown gravelly sand.

Minor in this association are the excessively drained Coloma and well drained Elston and Schoolcraft soils. These soils are in landscape positions similar to those of the Kalamazoo and Oshtemo soils. Elston and Schoolcraft soils are loamy, and Coloma soils are sandy.

Most areas of this association are used for crops, including hay. Some areas are used as pasture or woodland.

The major soils are well suited or fairly well suited to such crops as corn and soybeans. Water erosion and droughtiness are the major management concerns. Tilth in the Kalamazoo soils and soil blowing and organic matter content in areas of the Oshtemo soils are additional concerns. The soils generally are well suited to pasture. Overgrazing and excessive runoff are management concerns. Surface compaction on the Kalamazoo soils and soil blowing on the Oshtemo soils are additional management concerns. No major limitations affect the use of these soils as woodland.

The major soils are generally well suited to building site development, but the moderately sloping soils are only fairly well suited. The soils are well suited or fairly well suited to septic tank absorption fields. A poor filtering capacity in the Kalamazoo soils and the slope in some areas are limitations. The Oshtemo soils generally are well suited to septic tank absorption fields, but the moderately sloping areas are only fairly well suited.

3. Coloma-Boyer Association

Nearly level to gently sloping, excessively drained and well drained, sandy soils on outwash plains

The major soils in this association are in areas on outwash plains where slope ranges from 0 to 6 percent.

This association makes up about 7 percent of the county. It is about 65 percent Coloma soils, 30 percent Boyer soils, and 5 percent soils of minor extent.

The Coloma soils are excessively drained. Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand.

The Boyer soils are well drained. Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the next part is strong brown, friable gravelly sandy loam; and the lower part is dark brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand.

Minor in this association are the well drained Spinks soils and the very poorly drained Houghton soils. Spinks soils are in landscape positions similar to those of the Coloma and Boyer soils. Houghton soils are in depressions and along drainageways.

Most areas of this association are used for crops, including hay. Some areas are used as pasture or woodland. A few areas are idle.

The major soils are fairly well suited or poorly suited to such crops as corn and soybeans. Soil blowing and droughtiness are the major management concerns. These soils are well suited or fairly well suited to pasture. Overgrazing is a management concern. In areas used as woodland, the equipment limitation and seedling mortality are management concerns on the Coloma soils.

The major soils are generally well suited to building site development and fairly well suited to septic tank absorption fields. A poor filtering capacity limits the use of Coloma and Boyer soils for septic tank absorption fields. The instability of cutbanks is a limitation on sites for shallow excavations.

4. Marlette-Oshtemo Association

Moderately sloping to steep, well drained, loamy soils on till plains, outwash plains, and moraines

The major soils in this association are on side slopes, knolls, and ridges. Slope ranges from 6 to 40 percent.

This association makes up about 21 percent of the county. It is about 45 percent Marlette soils, 40 percent Oshtemo soils, and 15 percent soils of minor extent.

Typically, the surface layer of the Marlette soils is very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam.

Typically, the surface layer of the Oshtemo soils is dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, very friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of about 80 inches is yellowish brown gravelly sand.

Minor in this association are the excessively drained Coloma soils, the well drained Tekenink soils, and the very poorly drained Houghton soils. Tekenink soils are in landscape positions similar to those of the Marlette and Oshtemo soils. Coloma soils are on side slopes. Houghton soils are in depressions and drainageways.

Most areas of this association are used for hay and pasture (fig. 3). Some areas are used as woodland. The

Figure 3.—A pastured area of the Marlette-Oshtemo association. Coloma soils are in the background.

moderately sloping areas are used mainly as cropland. A few steep and hilly areas are idle.

The major soils are poorly suited or generally unsuited to such crops as corn and soybeans. Water erosion and tilth are the major management concerns in areas of the Marlette soils. Water erosion, soil blowing, droughtiness, and low organic matter content are the major management concerns in areas of the Oshtemo soils. The major soils generally are well suited or fairly well suited to pasture, but the steep areas are generally unsuited. No major limitations affect the use of the soils as woodland in areas that have slopes of less than 18 percent. The erosion hazard and the equipment limitation are management concerns in the steeper areas.

In most areas the major soils are fairly well suited or poorly suited to building site development and septic tank absorption fields, but the steep areas are generally unsuited. The slope is the major limitation. Also, the instability of cutbanks is a limitation in areas of the Oshtemo soils and moderately slow permeability in the Marlette soils is a limitation on sites for septic tank absorption fields.

5. Perrinton-Ithaca-Marlette Association

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

The Perrinton soils in this association are on side slopes, knolls, and ridges at the higher elevations or at elevations similar to those of the Marlette soils. The Marlette soils are slightly higher on the landscape than the Ithaca soils. The Ithaca soils are on broad flats, low knolls, and ridges. Slope ranges from 0 to 18 percent.

This association makes up about 4 percent of the county. It is about 60 percent Perrinton soils, 20 percent Ithaca soils, 15 percent Marlette soils, and 5 percent soils of minor extent (fig. 4).

The Perrinton soils are nearly level to rolling and are well drained or moderately well drained. Typically, the surface layer is dark brown loam about 8 inches thick. The next 6 inches is dark brown, mottled, firm silty clay loam mixed with light brownish gray loam. The subsoil is dark brown, mottled, firm silty clay about 12 inches thick. The substratum to a depth of about 60 inches is brown, mottled silty clay loam.

The Ithaca soils are nearly level and gently

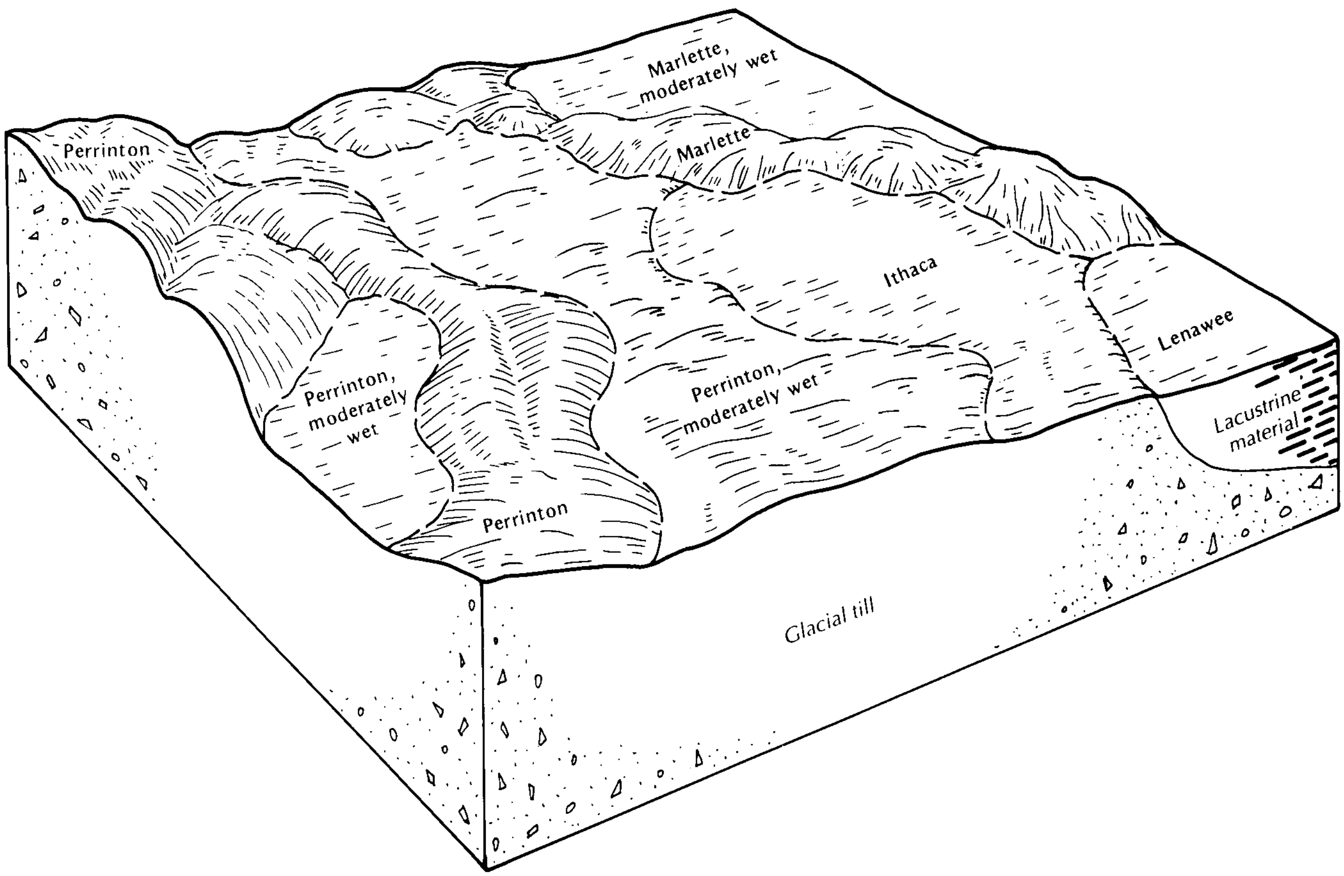

Figure 4.—Typical pattern of soils and parent material in the Perrinton-Ithaca-Marlette association.

undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The next 4 inches is dark brown, mottled, firm silty clay loam mixed with brown loam. The subsoil is about 17 inches thick. It is mottled. The upper part is dark brown, very firm silty clay, and the lower part is brown, firm silty clay loam. The substratum to a depth of about 60 inches is brown, mottled silty clay loam.

The Marlette soils are nearly level to gently rolling and are well drained or moderately well drained. Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam.

Minor in this association are the poorly drained Lenawee soils and the very poorly drained Houghton soils. Lenawee soils are on low flats and in depressions. Houghton soils are in depressions and drainageways.

Most areas of this association are used for crops, including hay. Some areas are used as pasture or woodland. A few areas are idle.

The major soils are generally well suited or fairly well suited to such crops as corn and soybeans and to pasture, but the more sloping areas are poorly suited to crops. Water erosion and tilth are the major management concerns. Wetness is an additional concern on the Ithaca soils. Grazing when the soils are too wet can cause surface compaction and excessive runoff. Generally, few limitations affect the use of these soils as woodland. Because of wetness, however, the use of equipment is limited on the Ithaca soils.

The major soils are fairly well suited or poorly suited to building site development. Wetness is the major limitation on the Ithaca soils. The rolling areas of the Marlette and Perrinton soils are limited by the slope. The shrink-swell potential is a limitation in the Perrinton soils. The Ithaca soils are generally unsuited to septic tank absorption fields because of wetness and slow permeability. The well drained Marlette and Perrinton soils are poorly suited to this use because of moderately slow or slow permeability.

6. Houghton-Sloan Association

Nearly level, very poorly drained, loamy and mucky soils on flood plains

The Houghton soils in this association are on the lower parts of the landscape and in depressions. The Sloan soils are on the slightly higher flats. Slope ranges from 0 to 2 percent.

This association makes up about 8 percent of the county. It is about 55 percent Houghton and similar soils, 30 percent Sloan and similar soils, and 15 percent soils of minor extent.

Typically, the surface layer of the Houghton soils is black muck about 14 inches thick. Below this to a depth of about 60 inches is black and dark reddish brown, friable muck.

Typically, the surface layer of the Sloan soils is very dark brown and very dark grayish brown loam about 20 inches thick. The subsoil is about 14 inches thick. It is mottled. The upper part is dark gray, firm, stratified clay loam and sandy loam, and the lower part is dark grayish brown, friable sandy loam. Below this is black, friable sandy loam about 14 inches thick. The substratum to a depth of about 60 inches is dark gray sand.

Minor in this association are the poorly drained Sebewa and Granby soils and the very poorly drained Adrian soils. Granby and Sebewa soils are in landscape positions similar to those of the Sloan soils. Adrian soils are in landscape positions similar to those of the Houghton soils.

Most areas of this association have a permanent cover of natural vegetation, including trees (fig. 5). They are used mainly for recreational development or wildlife habitat.

The major soils are generally unsuited to such crops as corn and soybeans and are poorly suited to pasture. Wetness is the main limitation. The Houghton soils are subject to ponding. The Sloan soils are subject to flooding. In areas used as woodland, the equipment limitation, seedling mortality, and the windthrow hazard are management concerns.

The major soils are generally unsuited to building site development and septic tank absorption fields. Wetness is the major limitation. Flooding is a hazard on the Sloan soils.

7. Oshtemo-Coloma-Marlette Association

Moderately sloping to steep, excessively drained and well drained, sandy and loamy soils on till plains, outwash plains, and moraines

The major soils in this association are on side slopes, knolls, and ridges. Slope ranges from 6 to 40 percent.

This association makes up about 22 percent of the county. It is about 47 percent Oshtemo and similar soils, 23 percent Coloma and similar soils, 15 percent Marlette and similar soils, and 15 percent soils of minor extent (fig. 6).

The Oshtemo soils are well drained. Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, very friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of about 80 inches is yellowish brown gravelly sand.

The Coloma soils are excessively drained. Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand.

The Marlette soils are well drained. Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam.

Minor in this association are the well drained Boyer soils and the very poorly drained Houghton soils. Boyer soils are in landscape positions similar to those of the Oshtemo, Coloma, and Marlette soils. Houghton soils are in depressions and drainageways.

Most areas of this association are used for hay and pasture. Some are used as woodland. The gently rolling areas are used mainly for crops. A few areas are idle.

The major soils generally are poorly suited or unsuited to such crops as corn and soybeans, but the moderately sloping soils are fairly well suited. Water erosion and tilth are the major management concerns in areas of the Marlette soils. Water erosion, soil blowing, droughtiness, and the organic matter content are management concerns in areas of the Oshtemo and

Figure 5.—Typical vegetation on the Houghton-Sloan association. Houghton soils, in the foreground, support herbaceous vegetation. Sloan soils, in the background, support trees.

Coloma soils. The major soils generally are well suited or fairly well suited to pasture, but the steep soils are generally unsuited. Few limitations affect the use of the soils as woodland in areas that have slopes of less than 18 percent. The erosion hazard and the equipment limitation are management concerns in the steeper areas. Also, seedling mortality is a concern on the Coloma soils.

In most areas the major soils are fairly well suited or poorly suited to building site development and septic tank absorption fields, but the steep areas generally are unsuited. The slope is the major limitation. Also, the instability of cutbanks is a limitation on the Oshtemo and Coloma soils, and moderately slow permeability in the Marlette soils is a limitation on sites for septic tank absorption fields.

8. Coloma-Boyer-Spinks Association

Moderately sloping to steep, excessively drained and well drained, sandy soils on outwash plains and moraines

The major soils in this association are on side slopes, knolls, and ridges. Slope ranges from 6 to 40 percent.

This association makes up about 13 percent of the

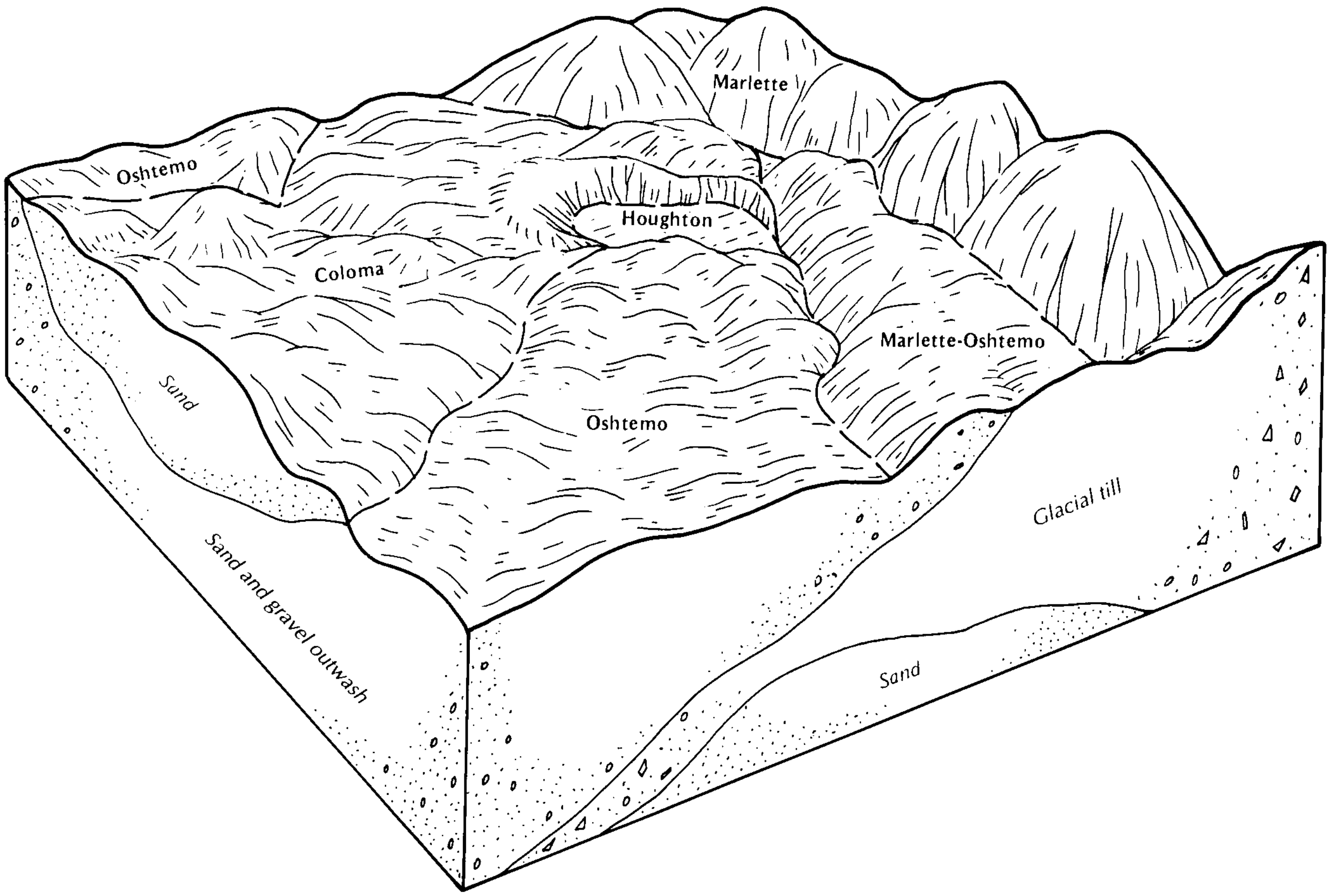

Figure 6.—Typical pattern of soils and parent material in the Oshtemo-Coloma-Marlette association.

county. It is about 55 percent Coloma and similar soils, 25 percent Boyer and similar soils, 10 percent Spinks and similar soils, and 10 percent soils of minor extent.

The Coloma soils are excessively drained. Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand.

The Boyer soils are well drained. Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the next part is strong brown, friable gravelly sandy loam; and the lower part is dark brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand.

The Spinks soils are well drained. Typically, the surface layer is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown, very friable sand about 17 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand.

Minor in this association are the moderately well drained Brems soils and the very poorly drained Houghton soils. Brems soils are slightly lower on the landscape than the Coloma and Boyer soils. Houghton soils consist of muck more than 51 inches thick. They are in deep depressions.

Most areas of this association are used as hayland or woodland. Some areas are used as pasture or are idle. The moderately sloping areas are used mainly for crops, including hay.

The major soils generally are fairly well suited or poorly suited to such crops as corn and soybeans and to pasture, but the steep areas are generally unsuited. The less sloping areas of the Boyer and Spinks soils are well suited to pasture. Water erosion, soil blowing, droughtiness, and low organic matter content are the major management concerns if the soils are used for crops. Overgrazing is a management concern if the soils are used for pasture. In areas used as woodland, the equipment limitation, the erosion hazard, and seedling mortality are management concerns.

Because of the slope, the major soils are poorly suited or generally unsuited to septic tank absorption fields and building site development, but the moderately sloping areas are fairly well suited. The instability of cutbanks is a limitation. A poor filtering capacity further limits the use of the Coloma and Boyer soils for septic tank absorption fields.

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, 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, Oshtemo sandy loam, 6 to 12 percent slopes, is a phase of the Oshtemo series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

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. Marlette-Oshtemo complex, 0 to 6 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Histosols and Aquents, ponded, is an undifferentiated group in this survey area.

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. The map unit 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 Barry County do not match those on the soil maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences are the result of modifications or refinements in soil series concepts, variations in the intensity of mapping, or the extent of the soils in the survey area.

Table 4 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

2—Adrian muck. This nearly level or slightly depressional, very poorly drained, organic soil is in swamps, along waterways, and in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is black muck about 10 inches thick. The subsurface layer is dark reddish brown muck about 14 inches thick. The substratum to a depth of about 60 inches is pale brown and gray sand and stratified coarse sand and gravelly sand. In some areas it is loamy or marly. In other areas the organic material is more than 50 inches thick.

Included with this soil in mapping are small areas of the very poorly drained, sandy Glendora soils on flood plains along perennial streams. These soils make up 5 percent of the unit.

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

Most areas are used as woodland or are covered with wetland shrubs or marsh grasses. Some areas are used as cropland or unimproved pasture.

This soil generally is unsuited to cropland because most areas do not have adequate outlets for drainage. In areas where outlets are available, however, the soil can be drained and such crops as corn and soybeans or specialty crops, such as potatoes, carrots, onions, and mint, can be grown. The major management concerns are wetness and soil blowing. Ditches and subsurface drains can lower the water table and reduce the hazard of ponding. Field windbreaks, buffer strips, and winter cover crops help to control soil blowing.

This soil is poorly suited to pasture. The major management concerns are wetness and the hazard of ponding. Planting reed canarygrass and other forage species that are water tolerant and resistant to heaving can help to maintain the plant cover. Where adequate outlets are available, surface drains can reduce the wetness and the hazard of ponding. Proper stocking rates, pasture rotation, and restricted use during wet periods are needed.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are the major management concerns. The use of heavy harvesting equipment is limited because of wetness and low strength. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on this soil. Special harvesting equipment is needed. The equipment should be used only when the soil is frozen. Because of the wetness and the resulting seedling mortality, trees are generally not planted on this soil. Because of the high water table, the trees growing on the soil are shallow rooted. Many may be blown down by high winds. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Windthrown trees should be removed periodically.

Because of the wetness, the hazard of ponding, and low strength in the organic material, this soil generally is unsuited to septic tank absorption fields and building site development. Soils that are better suited to these uses generally are nearby.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is M/4c.

5B—Ithaca loam, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on broad flats, low knolls, and low ridges. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The next 4 inches is dark brown, mottled, firm silty clay mixed with brown loam. The subsoil is about 17 inches thick. It is mottled. The upper part is dark brown, very firm silty clay, and the lower part is brown, firm silty clay loam. The substratum to a depth of about 60 inches is brown, mottled silty clay loam. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Capac and Perrinton soils. Capac soils have less clay in the subsoil than the Ithaca soil. They are in landscape positions similar to those of the Ithaca soil. Perrinton soils are well drained or moderately well drained and are higher on the landscape than the Ithaca soil. Included soils make up 5 to 10 percent of the unit.

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

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is well suited to such crops as corn, soybeans, and winter wheat. The major management concerns are the erosion hazard, wetness, and tilth. Cropping systems that include close-growing crops, such as hay and small grain, cover crops, and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control water erosion. A combination of surface and subsurface drains is effective in removing excess water. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth. Including grasses and legumes in the cropping sequence can improve soil structure and increase the rate of water infiltration.

This soil is well suited to pasture. The major management concerns are wetness, overgrazing, and soil 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. Surface drains are effective in removing excess water.

If this soil is used as woodland, the equipment limitation is a major management concern. The use of heavy equipment is briefly restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is frozen or nearly dry.

Because of the wetness and the slow permeability, this soil generally is unsuited to septic tank absorption fields. It is poorly suited to building site development because of the wetness. The building sites should be raised through additions of well compacted fill material. Surface or subsurface drains help to lower the water table.

The land capability classification is IIe. The woodland ordination symbol is 4W. The Michigan soil management group is 1.5b.

6B—Boyer loamy sand, 0 to 6 percent slopes. This nearly level to gently sloping, well drained soil is on flats, low knolls, and ridges. Individual areas are long and narrow or irregular in shape and range from 3 to 170 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the next part is strong brown, friable gravelly sandy loam; and the lower part is dark brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas it is banded sand and loamy sand. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the sandy Coloma and Spinks soils. Coloma soils are excessively drained. Spinks soils have less clay in the subsoil than the Boyer soil. Both of the included soils are in landscape positions similar to those of the Boyer soil. They make up 5 to 12 percent of the unit.

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

Most areas are used as cropland or pasture. Some are used as woodland or as recreational areas. Much of the major urban development in the county has occurred in areas of this soil along the Thornapple River.

This soil is fairly well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concerns are droughtiness, soil blowing, and the organic matter content. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface can help to conserve moisture and control soil blowing. Fall-seeded crops, such as winter wheat and rye, and small grain seeded in early spring can make good use of the limited supply of available water. Returning crop residue to the soil and growing green manure crops can increase the organic matter content and the available water capacity. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing.

This soil is well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil generally is well suited to building site development and fairly well suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water supplies. Pressurized sewage distribution systems can achieve uniform discharge rates from all points in the absorption field. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The land capability classification is IIIs. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

6C—Boyer loamy sand, 6 to 12 percent slopes. This moderately sloping and gently rolling, well drained soil is on side slopes, low knolls, and ridges. Individual areas are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the next part is strong brown, friable gravelly sandy loam; and the lower part is dark brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas it is banded sand and loamy sand. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the sandy Coloma and Spinks soils. Coloma soils are excessively drained. Spinks soils have less clay in the subsoil than the Boyer soil. Both of the included soils are in landscape positions similar to those of the Boyer soil. They make up 5 to 12 percent of the unit.

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

Most areas are used as cropland or pasture. Some areas are used as woodland. Some of the acreage is idle land. Much of the major urban development in the county has occurred in areas of this soil along the Thornapple River.

This soil is fairly well suited to such crops as corn and soybeans. The major management concerns are droughtiness, water erosion, soil blowing, and the organic matter content. Cropping systems that include close-growing crops, such as hay and small grain, can help to control water erosion and soil blowing. Returning crop residue to the soil and growing green manure crops can increase the organic matter content and the available water capacity. A system of conservation tillage that does not invert the soil and that leaves the maximum amount of crop residue on the surface also helps to control water erosion and soil blowing and conserves moisture. Fall-seeded crops, such as winter wheat and rye, and small grain seeded in early spring can make good use of the limited supply of available water. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing.

This soil is well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to soil blowing and water erosion. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

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. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The slope and a poor filtering capacity are limitations on sites for 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 in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water supplies. Pressurized sewage distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

6D—Boyer loamy sand, 12 to 18 percent slopes. This 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 loamy sand about 9 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the next part is strong brown, friable gravelly sandy loam; and the lower part is dark brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas it is banded sand and loamy sand. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the sandy Coloma and Spinks soils. Coloma soils are excessively drained. Spinks soils have less clay in the subsoil than the Boyer soil. Both of the included soils are in landscape positions similar to those of the Boyer soil. Also included are some areas of steep or very steep Boyer soils around lakes and swamps and along rivers. Included soils make up 5 to 12 percent of the unit.

Permeability is moderately rapid in the upper part of this Boyer soil and very rapid in the lower part. The available water capacity is low. Surface runoff is medium on cropland and slow on woodland and in pastured areas.

Most areas are used as woodland or hayland. Some areas are used as pasture.

This soil is poorly suited to such crops as corn and soybeans. The major management concerns are droughtiness, erosion, soil blowing, and the organic matter content. Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the available water capacity. Cropping systems that include close-growing crops, such as hay and small grain, can help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion and soil blowing and conserves moisture. Fall-seeded crops, such as hay and small grain, and small grain that is seeded early in spring can make good use of the limited supply of available moisture. Field windbreaks or buffer strips and rough tillage help to control soil blowing.

This soil is fairly well suited to pasture. The major management concerns are droughtiness, the erosion hazard, and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and can greatly increase the susceptibility to soil blowing and water erosion. Proper stocking rates, pasture rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

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. Land shaping is necessary in some areas. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The slope and a poor filtering capacity are limitations on sites for 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 in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water supplies. Pressurized sewage distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IVe. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

6E—Boyer loamy sand, 18 to 40 percent slopes. This hilly and steep, well drained soil is on side slopes, high 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 loamy sand about 9 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the next part is strong brown, friable gravelly sandy loam; and the lower part is dark brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas it is banded sand and loamy sand. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the sandy Coloma and Spinks soils. Coloma soils are excessively drained. Spinks soils have less clay in the subsoil than the Boyer soil. Both of these included soils are in landscape positions similar to those of the Boyer soil. Also included are some areas of very steep Boyer soils around depressions. Included soils make up 5 to 12 percent of the unit.

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

Most areas are used as woodland. Some of the acreage is idle land.

Because of the slope and a severe erosion hazard, this soil generally is unsuitable as cropland and pasture. In areas where the slope is more than 25 percent, a permanent plant cover is needed to minimize the erosion hazard.

If this soil is used as woodland, the erosion hazard and the equipment limitation are management concerns. Because of the erosion hazard, logging roads, skid roads, and landings should be established on gentle grades and water should be removed by water bars, culverts, and drop structures. Caution is needed if ordinary crawler tractors and rubber-tired skidders are operated on these slopes. Special care is needed in laying out logging roads and landings and in operating equipment. The roads should be designed so that they conform to the topography. The grade should be kept as low as possible. Seeding skid roads, logging roads, and landings after the trees are logged helps to control erosion.

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

The land capability classification is VIIe. The woodland ordination symbol is 4R. The Michigan soil management group is 4a.

7A—Brady sandy loam, 0 to 3 percent slopes. This nearly level and very gently sloping, somewhat poorly drained soil is on flats and in depressions and drainageways. Individual areas are long and narrow or irregular in shape and range from 3 to 110 acres in size.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 32 inches thick. The upper part is dark yellowish brown and yellowish brown, mottled, friable sandy loam. The lower part is yellowish brown, mottled, very friable loamy sand. The upper part of the substratum is pale brown, mottled coarse sand. The lower part to a depth of about 60 inches is yellowish brown gravelly sand. In some areas the gravelly sand is within a depth of 40 inches. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the sandy Granby and Thetford soils. Granby soils are poorly drained and are in depressions and drainageways. Thetford soils are on low knolls. Included soils make up 2 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Brady soil and very rapid in the lower part. The available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 1 to 3 feet from early fall to late spring.

Most areas are used as cropland or pasture. Some areas are used as woodland.

This soil is well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concerns are wetness, soil blowing, and droughtiness. Cropping systems that include close-growing crops, such as hay and small grain, can help to control soil blowing. A combination of surface and subsurface drains is effective in removing excess water. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control soil blowing and conserve moisture. Buffer strips and field windbreaks help to control soil blowing.

This soil is well suited to pasture. The major management concerns are wetness, overgrazing, 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. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, provides a long-lived stand that has a long grazing season. A surface and subsurface drainage system can be effective in removing excess water.

If this soil is used as woodland, the equipment limitation is a management concern. The use of heavy equipment is briefly restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is frozen or nearly dry.

This soil is poorly suited to building site development and septic tank absorption fields because of the wetness. Building sites should be raised through additions of well compacted fill material. Surface or subsurface drains help to lower the water table. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. Filling or mounding with suitable soil material can raise septic tank absorption fields above the seasonal high water table.

The land capability classification is IIw. The woodland ordination symbol is 3W. The Michigan soil management group is 4b.

9B—Capac fine sandy loam, 0 to 4 percent slopes. This nearly level and very gently sloping, somewhat poorly drained soil is in broad very gently sloping areas, in slight depressions, and on low ridges. Individual areas are irregular in shape and range from 3 to 600 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The next 7 inches is dark yellowish brown, mottled, firm clay loam mixed with brown sandy loam. The subsoil is about 9 inches thick. It is yellowish brown and mottled. The upper part is firm clay loam, and the lower part is friable loam. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In some areas the subsoil contains more clay. In other areas the upper part of the soil is sandy loam about 20 inches thick.

Included with this soil in mapping are small areas of Marlette, Parkhill, and Selfridge soils. Marlette soils are well drained or moderately well drained and are higher on the landscape than the Capac soil. Parkhill soils are poorly drained and are in depressions. Selfridge soils have a sandy surface soil more than 20 inches thick. They are in landscape positions similar to those of the Capac soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Capac soil. The 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 early fall to late spring.

Most areas are used as cropland. Some areas are used as pasture or woodland.

If drained, this soil is well suited to such crops as corn and soybeans. The major management concerns are water erosion, soil blowing, wetness, and tilth. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface helps to control water erosion and soil blowing. A combination of surface drains and subsurface tile drains is effective in removing excess water. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth. Including grasses and legumes in the cropping sequence can improve soil structure and increase the rate of water infiltration.

This soil is well suited to pasture. The major management concerns are wetness, overgrazing, and soil 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. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, provides a long-lived stand that has a long grazing season. A surface and subsurface drainage system can be effective in removing excess water.

If this soil is used as woodland, the equipment limitation is a management concern. The use of heavy equipment is briefly restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is frozen or nearly dry.

Because of the wetness and the moderately slow permeability, this soil is generally unsuited to septic tank absorption fields. It is poorly suited to building site development because of the wetness. Building sites should be raised through additions of well compacted fill material. Surface or subsurface drains help to lower the water table.

The land capability classification is IIe. The woodland ordination symbol is 4W. The Michigan soil management group is 2.5b.

13—Colwood loam. This nearly level, poorly drained soil is on low flats and in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is black loam about 10 inches thick. The subsoil is about 14 inches thick. It is mottled. The upper part is gray, very firm silty clay loam, and the lower part is light brownish gray, friable fine sandy loam. The substratum to a depth of about 60 inches is gray, mottled loam and silt loam. In some areas the surface soil is more than 20 inches thick. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Kibbie and Parkhill soils. Kibbie soils are somewhat poorly drained and are on slight rises and low knolls. Parkhill soils are not stratified. They are in landscape positions similar to those of the Colwood soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Colwood soil. The available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from early fall to late spring.

Most areas are used as cropland or pasture. Some of the acreage is idle land.

If drained, this soil is well suited to such crops as corn, soybeans, and winter wheat. The major management concerns are wetness and tilth. If adequate outlets are available, a combination of surface and subsurface drains is effective in removing excess water. The soil tends to puddle and crust after heavy rains. Tilling when the soil is too wet can alter soil structure and cause cloddiness and compaction. Applying a system of conservation tillage, returning crop residue to the soil, and growing green manure crops improve tilth.

If drained, this soil is well suited to pasture. The major management concerns are wetness, ponding, and compaction. 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. A suitable legume-grass seeding mixture, such as one that includes birdsfoot trefoil, smooth bromegrass, and timothy, provides a long-lived stand that has a long grazing season. If adequate outlets are available, surface drains can remove excess water.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are the major management concerns. The use of heavy equipment is restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is relatively dry or frozen. Because of the wetness and the resulting seedling mortality, trees are generally not planted on this soil. Because of the seasonal high water table, the trees growing on the soil are shallow rooted. Many may be blown down by high winds. Harvest methods that do not leave the remaining trees widely spaced can reduce the hazard of windthrow. Windthrown trees should be removed periodically.

This soil generally is unsuited to building site development and septic tank absorption fields because of the ponding.

The land capability classification is IIw. The woodland ordination symbol is 2W. The Michigan soil management group is 2.5c-s.

15—Edwards muck. This nearly level or slightly depressional, very poorly drained, organic soil is in swamps, along waterways, and in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is black muck about 20 inches thick. The next 2 inches also is black muck. The substratum to a depth of about 60 inches is gray marl. In some areas it is loamy or sandy. In other areas the organic material is more than 50 inches thick.

Included with this soil in mapping are small areas of the loamy Sloan soils on flood plains along perennial drainageways. These soils make up 5 to 15 percent of the unit.

Permeability is moderately slow to moderately rapid in the mucky part of the Edwards soil and varies in the underlying marl. The available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from early fall to late spring.

Most areas support native vegetation, including trees. Some areas are used as unimproved pasture.

This soil generally is unsuited to crops because most areas do not have adequate outlets for drainage. In areas where outlets are available, however, the soil can be drained and such crops as corn and soybeans or specialty crops, such as potatoes, carrots, onions, and mint, can be grown. The major management concerns are wetness and soil blowing. Ditches and subsurface drains can lower the water table and reduce the hazard of ponding. Field windbreaks, buffer strips, and winter cover crops help to control soil blowing.

This soil is poorly suited to pasture. The major management concerns are the wetness and the hazard of ponding. Planting reed canarygrass and other forage species that are water tolerant and resistant to heaving helps to maintain the plant cover. Where adequate outlets are available, surface drains can reduce the wetness and the hazard of ponding. Proper stocking rates, pasture rotation, and restricted use during wet periods are needed.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are management concerns. The use of heavy equipment is restricted in the spring and in other excessively wet periods. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on this soil. Special harvesting equipment is needed. The equipment should be used only when the soil is frozen. Because of the wetness and the resulting seedling mortality, trees are not generally planted on this soil. Because of the high water table, the trees growing on the soil are shallow rooted. Many may be blown down by high winds. Harvest methods that do not leave the remaining trees widely spaced can reduce the hazard of windthrow. Windthrown trees should be removed periodically.

Because of the wetness, the hazard of ponding, and low strength in the organic material and in the underlying marl, this soil generally is unsuited to building site development and septic tank absorption fields. Soils that are better suited to these uses generally are nearby.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is M/mc.

16—Udorthents and Udipsamments, 0 to 6 percent slopes. These nearly level to gently sloping, somewhat excessively drained to somewhat poorly drained soils are in areas that have been disturbed. The original surface layer, subsoil, and part of the substratum have been removed, or the surface has been covered with several feet of fill. In some areas the soils are underlain by muck. The soil material has been so altered that identification of the soil series is not feasible. Individual areas range from 3 to 40 acres in size.

Typically, the surface layer of the Udorthents is dark brown loam about 2 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, friable, mixed loam and clay loam.

Typically, the surface layer of the Udipsamments is very dark grayish brown loamy sand about 2 inches thick. The substratum to a depth of about 60 inches is light yellowish brown, loose sand.

These soils vary greatly in some important soil properties, especially texture, permeability, and drainage.

Most areas are used for building site development or are idle. Some areas are used for sanitary landfills. Onsite investigation is necessary to determine the suitability of individual areas for specific uses.

This map unit is not assigned to interpretive groups.

18—Glendora loamy fine sand. This nearly level, very poorly drained soil is on flood plains. It is subject to flooding. Individual areas are long and narrow or irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is very dark gray loamy fine sand about 6 inches thick. The substratum extends to a depth of 60 inches or more. In sequence downward, it is olive gray, mottled, stratified fine sandy loam and very fine sand; light brownish gray, mottled fine sand; very dark grayish brown fine sand; and olive gray and dark grayish brown very fine sand. In some areas the surface layer is muck. In other areas the substratum is loamy.

Included with this soil in mapping are small areas of the somewhat poorly drained Algansee soils and the loamy Sloan soils. Algansee soils are on knolls and natural levees. Sloan soils are in landscape positions similar to those of the Glendora soil. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Glendora soil. The available water capacity is low. Surface runoff is very slow or ponded. The seasonal high water table is near or at the surface from early fall to late spring.

Most areas support native flood plain vegetation, including trees and brush (fig. 7). Some areas are used as pasture. Because of the wetness and the hazard of flooding, this soil generally is unsuited to cropland and is poorly suited to pasture. If adequate outlets are available, surface drains can reduce the wetness. Planting reed canarygrass and other water-tolerant forage species helps to maintain the plant cover. Proper stocking rates, pasture rotation, and restricted use during wet periods are needed.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are management concerns. The use of heavy equipment is limited by the wetness and frequent flooding. The equipment should be used only when the soil is frozen or nearly dry. Because of the high water table, the trees growing on the soil are shallow rooted. Some may be blown down by high winds. Harvest methods that do not leave the remaining trees widely spaced can reduce the hazard of windthrow. Windthrown trees should be removed periodically. Because of the wetness and the hazard of flooding, trees generally are not planted on this soil.

Because of the wetness and the flooding, this soil generally is unsuited to building site development and septic tank absorption fields.

The land capability classification is VIw. The woodland ordination symbol is 3W. The Michigan soil management group is L-4c.

19—Granby sand. This nearly level, poorly drained soil is on broad flats and in depressions and drainageways. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 340 acres in size.

Typically, the surface layer is black sand about 10 inches thick. The next 5 inches is very dark gray, mottled, very friable sand. The subsoil is dark gray, very friable sand about 21 inches thick. The substratum to a depth of about 60 inches is yellowish brown and grayish brown, mottled sand. In some areas the surface layer is muck. In other areas the subsoil is loamy. In places the soil is gravelly sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford soils on low knolls. Included soils make up 2 to 10 percent of the unit.

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

Most areas support native vegetation, including trees. Some areas are used as cropland or unimproved pasture.

This soil generally is unsuited to crops because most areas do not have adequate outlets for drainage. If adequate outlets are available, however, such crops as corn or soybeans or specialty crops, such as potatoes, carrots, onions, and mint, can be grown. The major management concerns are wetness and soil blowing. A combination of surface and subsurface drains is effective in removing excess water. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface helps to control soil blowing and conserves moisture. Establishing field windbreaks or buffer strips, applying a system of rough

Figure 7.—A wooded area of Glendora loamy fine sand.

tillage, and ridging at an angle to the prevailing wind help to control soil blowing.

This soil is poorly suited to pasture. The major management concerns are the wetness and the hazard of ponding. Where adequate outlets are available, surface and subsurface drains can reduce the wetness and the hazard of ponding. Planting reed canarygrass and other forage species that are water tolerant and resistant to heaving can help to maintain the plant cover. Proper stocking rates, pasture rotation, and restricted use during wet periods are needed.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are management concerns. The use of heavy equipment is restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is relatively dry or frozen. Because of the wetness and the resulting seedling mortality, trees are not generally planted on this soil. Because of the high water table, the trees growing on the soil are shallow rooted. Many may be blown down by high winds. Harvest methods that do not leave the remaining trees widely spaced can reduce the hazard of windthrow. Windthrown trees should be removed periodically.

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

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is 5c.

20B—Tekenink fine sandy loam, 1 to 6 percent slopes. This nearly level to undulating, well drained soil is on low knolls and ridges. Individual areas are irregular in shape and range from 3 to 160 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is yellowish brown, friable fine sandy loam about 6 inches thick. The subsoil is mixed strong brown and yellowish brown, firm fine sandy loam about 38 inches thick. The substratum to a depth of about 60 inches is yellowish brown loamy sand. In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the sandy Spinks soils. These soils are in landscape positions similar to those of the Tekenink soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the Tekenink soil. The available water capacity also is moderate. Surface runoff is slow.

Most areas are used as cropland. Some areas are used as woodland or pasture.

This soil is well suited to such crops as corn and soybeans. The major management concerns are water erosion, soil blowing, and the organic matter content. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control erosion and soil blowing. Buffer strips or field windbreaks help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

This soil is well suited to pasture. The major management concerns are water erosion, soil blowing, and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to water erosion and soil blowing. Proper stocking rates, pasture rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil generally is well suited to septic tank absorption fields and building site development. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The land capability classification is IIe. The woodland ordination symbol is 4A. The Michigan soil management group is 3a.

20C—Tekenink fine sandy loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on side slopes, low knolls, and ridges. Individual areas are irregular in shape and range from 3 to 300 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is yellowish brown, friable fine sandy loam about 6 inches thick. The subsoil is mixed strong brown and yellowish brown, firm fine sandy loam about 38 inches thick. The substratum to a depth of about 60 inches is yellowish brown loamy sand. In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the sandy Spinks soils. These soils are in landscape positions similar to those of the Tekenink soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the Tekenink soil. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as woodland. Some areas are used as cropland or pasture.

This soil is fairly well suited to such crops as corn and soybeans. The major management concerns are water erosion, soil blowing, and the organic matter content. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion and soil blowing. Buffer strips or field windbreaks help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

This soil is well suited to pasture. The major management concerns are water erosion, soil blowing, and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to water erosion and soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil is fairly well suited to septic tank absorption fields and building site development. The slope is the main limitation. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. Pressurized sewage distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 3a.

20D—Tekenink fine sandy loam, 12 to 18 percent slopes. This rolling, well drained soil is on side slopes, knolls, and ridges. Escarpments are common around lakes and swamps and along rivers. Individual areas are irregular in shape and range from 3 to 110 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is yellowish brown, friable fine sandy loam about 6 inches thick. The subsoil is mixed strong brown and yellowish brown, firm fine sandy loam about 38 inches thick. The substratum to a depth of about 60 inches is yellowish brown loamy sand. In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the sandy Spinks soils. These soils are in landscape positions similar to those of the Tekenink soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the Tekenink soil. The available water capacity is moderate. Surface runoff is rapid.

Most areas are used as woodland. Some areas are used as hayland or pasture.

This soil is poorly suited to such crops as corn and soybeans. The major management concerns are water erosion, soil blowing, and the organic matter content. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion and soil blowing. Buffer strips or field windbreaks help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

This soil is fairly well suited to pasture. The major management concerns are water erosion, soil blowing, and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to water erosion and soil blowing. Proper stocking rates, pasture rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil is poorly suited to building site development and septic tank absorption fields. The slope is the major limitation. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in most areas. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. Land shaping and pressure distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol is 4A. The Michigan soil management group is 3a.

20E—Tekenink fine sandy loam, 18 to 40 percent slopes. This hilly and steep, well drained soil is on side slopes, high knolls, and ridges. Slopes of more than 40 percent are common around swamps and lakes and along rivers. Individual areas are irregular in shape and range from 3 to 300 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is yellowish brown, friable fine sandy loam about 6 inches thick. The subsoil is mixed strong brown and yellowish brown, firm fine sandy loam about 38 inches thick. The substratum to a depth of about 60 inches is yellowish brown loamy sand. In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the sandy Spinks soils. These soils are in landscape positions similar to those of the Tekenink soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the Tekenink soil. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as woodland. Some areas are used as pasture or are idle.

Because of the slope and a severe erosion hazard, this soil generally is unsuitable as cropland and pasture. In areas where the slope is more than 25 percent, a permanent plant cover is needed to minimize the erosion hazard.

If this soil is used as woodland, the erosion hazard and the equipment limitation are management concerns. Because of the erosion hazard, logging roads and skid roads should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging roads, and skid roads after the trees are logged helps to establish a protective cover. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and landings and in operating equipment. The roads should be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible.

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

The land capability classification is VIIe. The woodland ordination symbol is 4R. The Michigan soil management group is 3a.

21—Houghton muck. This nearly level or slightly depressional, very poorly drained soil is in swamps, along waterways, and in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 700 acres in size.

Typically, the surface layer is black muck about 14 inches thick. Below this to a depth of about 60 inches is black and dark reddish brown, friable muck. In some areas the organic material is 16 to 50 inches thick and is underlain by a mineral or marly substratum.

Included with this soil in mapping are small areas of the sandy Glendora soils on flood plains along perennial streams. These soils make up 5 to 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the Houghton soil. The available water capacity is very high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from early fall to late spring.

Most areas support wetland shrubs or marsh grasses. A few areas are used as cropland or unimproved pasture.

This soil generally is unsuited to cropland because most areas do not have adequate outlets for drainage. In areas where outlets are available, however, the soil can be drained and such crops as corn and soybeans or specialty crops, such as potatoes, carrots, onions, and mint, can be grown. The major management concerns are wetness and soil blowing. Deep ditches and subsurface drains can lower the water table and reduce the hazard of ponding. Field windbreaks, buffer strips, and winter cover crops help to control soil blowing.

This soil is poorly suited to pasture. The major management concerns are the wetness and the hazard of ponding. Planting reed canarygrass and other forage species that are water tolerant and resistant to frost action can help to maintain the plant cover. If adequate outlets are available, surface drains can reduce the wetness and the hazard of ponding. Proper stocking rates, pasture rotation, and restricted use during wet periods are needed.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are the major management concerns. The use of harvesting equipment is limited by the wetness and by low strength in the organic material. Ordinary crawler tractors and rubber-tired skidders generally cannot be used on this soil. Special harvesting equipment is needed. The equipment should be used only when the soil is frozen. Because of the wetness, the trees growing on the soil are shallow rooted. Many may be blown down by high winds. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Windthrown trees should be removed periodically. Because of the wetness and the resulting seedling mortality, trees are generally not planted on this soil.

This soil is generally unsuited to septic tank absorption fields and building site development because of the wetness, the hazard of ponding, and low strength in the organic material. Soils that are better suited to these uses generally are nearby.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is Mc.

22A—Kalamazoo loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad flats. Individual areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsoil is about 34 inches thick. It is brown. The upper part is firm sandy clay loam and gravelly sandy clay loam, the next part is friable gravelly sandy loam, and the lower part is very friable very gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown, stratified sand and gravel. In some areas the surface layer is more than 10 inches thick and is darker. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the sandy Spinks soils. These soils are in landscape positions similar to those of the Kalamazoo soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the

Kalamazoo soil and rapid in the lower part. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concern is tilth. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface conserves moisture, increases the rate of water infiltration, and helps to maintain tilth. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and planting green manure crops improve tilth.

This soil is well suited to pasture. Grazing when the soil is excessively wet can cause compaction and poor soil structure. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil generally is well suited to building site development. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. The soil is only fairly well suited to septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Pressurized sewage distribution systems can achieve uniform discharge rates from all points in the absorption field. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IIs. The woodland ordination symbol is 4A. The Michigan soil management group is 3/5a.

22B—Kalamazoo loam, 2 to 6 percent slopes. This very gently sloping and gently sloping, well drained soil is on broad flats, low knolls, and ridges. Individual areas are irregular in shape and range from 3 to 1,500 acres in size.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsoil is about 34 inches thick. It is brown. The upper part is firm sandy clay loam and gravelly sandy clay loam, the next part is friable gravelly sandy loam, and the lower part is very friable gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown, stratified sand and gravel. In some areas the surface layer is more than 10 inches thick and is darker. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the sandy Spinks soils. These soils are in landscape positions similar to those of the Kalamazoo soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Kalamazoo soil and rapid in the lower part. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is well suited to such crops as corn and soybeans. The major management concerns are water erosion and tilth. Cropping systems that include close-growing crops, such as hay and small grain, can help to control water erosion. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface helps to control water erosion, increases the rate of water infiltration, and conserves moisture. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. The major management concerns are compaction and water erosion. Grazing when the soil is excessively wet can cause compaction, damage the plant cover, and increase the runoff rate. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods can help to keep the pasture in good condition and control water erosion. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil generally is well suited to building site development. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. The soil is only fairly well suited to septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Pressurized sewage distribution systems can achieve uniform discharge rates from all points in the absorption field. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IIe. The woodland ordination symbol is 4A. The Michigan soil management group is 3/5a.

22C—Kalamazoo loam, 6 to 12 percent slopes. This moderately sloping, well drained soil is on side slopes, knolls, and ridges. Individual areas are irregular in shape and range from 3 to 110 acres in size.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsoil is about 34 inches thick. It is brown. The upper part is firm sandy clay loam and gravelly sandy clay loam, the next part is friable gravelly sandy loam, and the lower part is very friable very gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown, stratified sand and gravel. In some areas the surface layer is more than 10 inches thick and is darker. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the sandy Spinks soils. These soils are in landscape positions similar to those of the Kalamazoo soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Kalamazoo soil and rapid in the lower part. The available water capacity is moderate. Surface runoff is rapid.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is fairly well suited to such crops as corn and soybeans. The major management concerns are water erosion and tilth. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface helps to control erosion, increases the rate of water infiltration, and conserves moisture. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. The major management concerns are compaction and water erosion. Grazing when the soil is excessively wet can cause compaction, damage the plant cover, and increase the runoff rate. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition and help to control water erosion. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil is fairly well suited to building site development and septic tank absorption fields. The slope is the main limitation. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water supplies. Pressurized sewage distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 3/5a.

22D—Kalamazoo loam, 12 to 18 percent slopes. This strongly sloping, 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 loam about 10 inches thick. The subsoil is about 34 inches thick. It is brown. The upper part is firm sandy clay loam and gravelly sandy clay loam, the next part is friable gravelly sandy loam, and the lower part is very friable very gravelly loamy sand. The substratum to a depth of about 60 inches is yellowish brown, stratified sand and gravel. In some areas the surface layer is more than 10 inches thick and is darker. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the sandy Spinks soils. These soils are in landscape positions similar to those of the Kalamazoo soil. Also included are some areas of steep or very steep Kalamazoo soils around lakes and swamps and along drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of this Kalamazoo soil and rapid in the lower part. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as hayland. Some areas are used as woodland or are idle.

This soil is poorly suited to such crops as corn and soybeans. The major management concerns are water erosion and tilth. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface helps to control water erosion, increases the rate of water infiltration, and conserves moisture. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is fairly well suited to pasture. The major management concerns are water erosion and compaction. Grazing when the soil is wet or overgrazing can cause compaction, damage the plant cover, and increase the runoff rate. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition and help to control water erosion. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil is poorly suited to building site development and septic tank absorption fields. The slope is the major limitation. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in most areas. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The slope and a poor filtering capacity are limitations on sites for septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function 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. Pressurized sewage distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IVe. The woodland ordination symbol is 4A. The Michigan soil management group is 3/5a.

23—Lenawee silty clay loam. This nearly level, poorly drained soil is on broad flats and in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is black silty clay loam about 7 inches thick. The subsoil is about 16 inches thick. It is mottled. The upper part is very dark gray, firm silty clay loam, and the lower part is gray and olive, very firm silty clay. The substratum to a depth of about 60 inches is olive, mottled silty clay loam. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Parkhill soils. These soils have less clay in the subsoil than the Lenawee soil and are not stratified. They are in landscape positions similar to those of the Lenawee soil. They make up 2 to 5 percent of the unit.

Permeability is slow in the Lenawee soil. The available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from early fall to late spring.

Most areas are used as cropland. Some areas are used as pasture or are idle.

If drained, this soil is well suited to such crops as corn, soybeans, and winter wheat. The major management concerns are wetness and tilth. If adequate outlets are available, a combination of surface and subsurface drains is effective in removing excess water. The soil tends to puddle and crust after heavy rains. Tilling when the soil is too wet can alter soil structure and result in cloddiness and compaction. Applying a system of conservation tillage, returning crop residue to the soil, and growing green manure crops improve tilth.

If drained, this soil is well suited to pasture. The major management concerns are wetness, ponding, and compaction. 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. A suitable legume-grass seeding mixture, such as one that includes birdsfoot trefoil, smooth bromegrass, and timothy, provides a long-lived stand that has a long grazing season. If adequate outlets are available, surface drains can remove excess water.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are management concerns. The use of heavy equipment is restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is relatively dry or frozen. Because of the wetness and the resulting seedling mortality, trees generally are not planted on this soil. Because of the high water table, the trees growing on the soil are shallow rooted. Many may be blown down by high winds. Harvest methods that do not leave the remaining trees widely spaced can reduce the hazard of windthrow. Windthrown trees should be removed periodically.

Because of the ponding, this soil is generally unsuited to building site development and septic tank

Figure 8.—A typical area of Marlette loam, 2 to 6 percent slopes.

absorption fields. The slow permeability is an additional limitation on sites for septic tank absorption fields.

The land capability classification is IIw. The woodland ordination symbol is 2W. The Michigan soil management group is 1.5c.

24B—Marlette loam, 2 to 6 percent slopes. This gently undulating or undulating, well drained soil is on low knolls and ridges (fig. 8). Individual areas are irregular in shape and range from 3 to 340 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the seasonal high water table is at a depth of 2.5 to 6.0 feet. In other areas the subsoil contains more clay. In places the substratum is sandy below a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Capac soils. These soils are lower on the landscape than the Marlette soil. They make up 5 to 10 percent of the unit.

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

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is well suited to such crops as corn and soybeans. The major management concerns are water erosion and tilth. Cropping systems that include close-growing crops, such as hay and small grain, can help to control water erosion. A system of conservation tillage that does not invert the soil and that leaves the maximum amount of crop residue on the surface also helps to control water erosion. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. Grazing when the soil is excessively wet can cause compaction, damage the plant cover, and increase the runoff rate. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition and help to control water erosion. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil generally is well suited to building site development. It is poorly suited to septic tank absorption fields because of the moderately slow permeability. Pressurized distribution systems can achieve uniform discharge rates from all points in the absorption field. Enlarging the absorption field helps to overcome the restricted permeability.

The land capability classification is IIe. The woodland ordination symbol is 3A. The Michigan soil management group is 2.5a.

24C—Marlette loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on side slopes, low knolls, and ridges. Individual areas are irregular in shape and range from 3 to 130 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil contains more clay. In other areas the substratum is sandy below a depth of 40 inches.

Included with this soil in mapping are small areas of Capac, Oshtemo, and Spinks soils. Capac soils are somewhat poorly drained and are lower on the landscape than the Marlette soil. Oshtemo and Spinks soils are in landscape positions similar to those of the Marlette soil. Oshtemo soils have less clay in the subsoil than the Marlette soil and are underlain by sand and gravel below a depth of 40 inches. Spinks soils are sandy. Included soils make up 5 to 15 percent of the unit.

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

Most areas are used as cropland. Some areas are used as woodland or pasture.

This soil is fairly well suited to such crops as corn and soybeans. The major management concerns are water erosion and tilth. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. The major management concerns are compaction and water erosion. Grazing when the soil is excessively wet can cause compaction, damage the plant cover, and increase the runoff rate. Proper stocking rates, pasture rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition and help to control water erosion. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil is 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. The soil is poorly suited to septic tank absorption fields because of the moderately slow permeability and the slope. Pressurized distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. Enlarging the absorption field helps to overcome the restricted permeability.

The land capability classification is IIIe. The woodland ordination symbol is 3A. The Michigan soil management group is 2.5a.

24D—Marlette loam, 12 to 18 percent slopes. This rolling, well drained soil is on side slopes, knolls, and ridges. Escarpments are common around lakes and swamps and along rivers. Individual areas are irregular in shape and range from 3 to 160 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil contains more clay. In other areas the substratum is sandy below a depth of 40 inches.

Included with this soil in mapping are small areas of Capac, Oshtemo, and Spinks soils. Capac soils are somewhat poorly drained and are lower on the landscape than the Marlette soil. Oshtemo and Spinks soils are in landscape positions similar to those of the Marlette soil. Oshtemo soils have less clay in the subsoil than the Marlette soil and are underlain by sand and gravel below a depth of 40 inches. Spinks soils are sandy. Included soils make up 5 to 15 percent of the unit.

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

Most areas are used as hayland or pasture. Some areas are used as woodland or are idle.

This soil is poorly suited to such crops as corn and soybeans. The major management concerns are water erosion and tilth. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is fairly well suited to pasture. The major management concerns are compaction and water erosion. Grazing when the soil is excessively wet or overgrazing can cause compaction, damage the plant cover, and increase the runoff rate. Proper stocking rates, pasture rotation or strip grazing, and restricted use during wet periods can help to keep the pasture in good condition and control water erosion. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

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. Land shaping is necessary in most areas. Because of the slope and the moderately slow permeability, the soil is poorly suited to septic tank absorption fields. Land shaping and pressurized distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. Enlarging the absorption field helps to overcome the restricted permeability.

The land capability classification is IVe. The woodland ordination symbol is 3A. The Michigan soil management group is 2.5a.

24E—Marlette loam, 18 to 40 percent slopes. This hilly and steep, well drained soil is on side slopes, high knolls, and ridges. Slopes of more than 40 percent are around swamps and lakes and along rivers. Individual areas are irregular in shape and range from 3 to 150 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil contains more clay. In other areas the substratum is sandy below a depth of 40 inches.

Included with this soil in mapping are small areas of Oshtemo and Spinks soils. These soils are in landscape positions similar to those of the Marlette soil. Oshtemo soils have less clay in the subsoil than the Marlette soil and are underlain by sand and gravel below a depth of 40 inches. Spinks soils are sandy. Included soils make up 5 to 15 percent of the unit.

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

Most areas are used as woodland or are idle. Some areas are used as pasture.

Because of the slope and a severe hazard of water erosion, this soil generally is unsuitable as cropland and pasture. A permanent cover of vegetation, such as perennial grasses or trees, helps to control runoff and water erosion.

If this soil is used as woodland, the erosion hazard and the equipment limitation are management concerns. Because of the erosion hazard, skid roads and logging roads should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging roads, and skid roads after the trees are logged helps to establish a protective cover. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and landings and in operating equipment. The roads should be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled.

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

The land capability classification is VIIe. The woodland ordination symbol is 3R. The Michigan soil management group is 2.5a.

Figure 9.—Typical area of Histosols and Aquents.

25—Histosols and Aquents, ponded. These nearly level soils are in drainageways and depressions. In most areas they are ponded throughout the year (fig. 9). Individual areas are irregular in shape and range from 3 to 800 acres in size.

Typically, the Histosols formed in organic material and the Aquents formed in mineral material. Most areas support water-tolerant vegetation, including cattails, reeds, grasses, woody shrubs, and floating aquatic plants.

Access is limited for most of the year because of the ponding. Most areas can be used only as habitat for waterfowl, muskrats, and other birds and animals that prefer a wetland environment. These soils are not suitable for cropland or pasture because of the wetness, the hazard of ponding, and low strength of the organic material. They are generally unsuitable for woodland, recreational development, building site development, and septic tank absorption fields because of the ponding.

This map unit is not assigned to interpretive groups.

26B—Matherton loam, loamy substratum, 0 to 4 percent slopes. This nearly level and very gently sloping, somewhat poorly drained soil is on broad and narrow flats. Individual areas are long and narrow or irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 28 inches thick. It is mottled. The upper part is grayish brown, very firm clay loam; the next part is dark yellowish brown, firm sandy loam; and the lower part is yellowish brown, friable and very friable loamy coarse sand. The upper part of the substratum is brown, mottled coarse sand. The lower part to a depth of 74 inches is reddish brown and dark brown, firm clay loam. In some areas the subsoil contains less clay. In other areas the surface layer is gravelly sandy loam or gravelly loam.

Included with this soil in mapping are small areas of Brady and Sebewa soils. Brady soils have less clay in the subsoil than the Matherton soil. They are in landscape positions similar to those of the Matherton soil. Sebewa soils are poorly drained and are in depressions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Matherton soil, very rapid in the next part, and moderately slow in the lower part of the substratum. The available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 3 feet from late fall to early spring.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is well suited to such crops as corn, soybeans, and winter wheat. The major management concerns are wetness and tilth. A combination of surface and subsurface drains is effective in removing excess water. Tile drains should be installed above the moderately slowly permeable part of the substratum. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Tilling when the soil is wet can alter soil structure and result in cloddiness and compaction. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. The major management concerns are wetness, overgrazing, and soil 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. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, provides a long-lived stand that has a long grazing season. A surface and subsurface drainage system is effective in removing excess water.

If this soil is used as woodland, the equipment limitation is a major management concern. The use of heavy equipment is restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is relatively dry or frozen.

Because of the wetness, this soil is poorly suited to building site development and is generally unsuited to septic tank absorption fields. The building sites should be raised through additions of well compacted fill material. Surface or subsurface drains help to lower the water table. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The land capability classification is IIw. The woodland ordination symbol is 4W. The Michigan soil management group is 3/5b.

29C—Perrinton loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on side slopes, low knolls, and ridges. Some areas are dissected by shallow drainageways. Individual areas are irregular in shape and range from 3 to 120 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The next 6 inches is dark brown, firm silty clay loam mixed with light brownish gray loam. The subsoil is dark brown, firm silty clay about 12 inches thick. The substratum to a depth of about 60 inches is brown silty clay loam. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Ithaca and poorly drained Lenawee soils. Ithaca soils are lower on the landscape than the Perrinton soil. Lenawee soils are in depressions. Included soils make up 2 to 10 percent of the unit.

Permeability is slow in the Perrinton soil. The available water capacity is high. Surface runoff is medium.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is fairly well suited to such crops as corn and soybeans. The major management concerns are water erosion and tilth. Cropping systems that include close-growing crops, such as hay and small grain, can help to control water erosion. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. The major management concerns are water erosion and compaction. Grazing when the soil is excessively wet can cause compaction, damage the plant cover, and increase the runoff rate. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition and help to control water erosion. A suitable legume-grass seeding mixture, such as one that includes alfalfa and timothy, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

Because of the slope and the shrink-swell potential, this soil is only fairly well suited to building site development. Widening the foundation trenches and backfilling with suitable fill material can help to prevent the structural damage caused by shrinking and swelling. The buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

This soil is poorly suited to septic tank absorption fields because of the slow permeability and the slope. Pressurized distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. Enlarging the absorption field helps to overcome the restricted permeability.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 1.5a.

29D—Perrinton loam, 12 to 18 percent slopes. This 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 loam about 8 inches thick. The next 6 inches is dark brown, firm silty clay loam mixed with light brownish gray loam. The subsoil is dark brown, firm silty clay about 12 inches thick. The substratum to a depth of about 60 inches is brown silty clay loam. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Ithaca and poorly drained Lenawee soils. Ithaca soils are in depressions and on the lower parts of the landscape. Lenawee soils are in depressions. Included soils make up 2 to 10 percent of the unit.

Permeability is slow in the Perrinton soil. The available water capacity is high. Surface runoff is rapid.

Most areas are used as hayland. Some areas are used as woodland or are idle.

This soil is poorly suited to such crops as corn and soybeans. The major management concerns are water erosion and tilth. Cropping systems that include close-growing crops, such as hay and small grain, can help to control water erosion. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is fairly well suited to pasture. The major management concerns are water erosion and compaction. Grazing when the soil is excessively wet can cause compaction, damage the plant cover, and increase the runoff rate. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition and help to control water erosion. A suitable legume-grass seeding mixture, such as one that includes alfalfa and timothy, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

Because of the slope and the shrink-swell potential, this soil is poorly 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 most areas. Widening the foundation trenches and backfilling with suitable fill material can help to prevent the structural damage caused by shrinking and swelling.

The slope and the slow permeability limit the use of this soil as a site for septic tank absorption fields. Land shaping and pressure distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. Enlarging the absorption field helps to overcome the restricted permeability.

The land capability classification is IVe. The woodland ordination symbol is 4A. The Michigan soil management group is 1.5a.

29E—Perrinton loam, 18 to 40 percent slopes. This hilly and steep, well drained soil is on side slopes, high knolls, and ridges. Individual areas are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The next 6 inches is dark brown, firm silty clay loam mixed with light brownish gray loam. The subsoil is dark brown, firm silty clay about 12 inches thick. The substratum to a depth of about 60 inches is brown silty clay loam. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Ithaca soils in depressions and on the lower parts of the landscape. Also included, around deep depressions, are some areas where slopes are more than 40 percent. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the Perrinton soil. The available water capacity is high. Surface runoff is rapid.

Most areas are used as pasture or woodland. Some of the acreage is idle land.

Because of the slope and the hazard of water erosion, this soil generally is unsuitable as cropland and pasture. A permanent cover of vegetation, such as perennial grasses and trees, helps to control runoff and water erosion.

If this soil is used as woodland, the erosion hazard and the equipment limitation are management concerns. Because of the erosion hazard, logging roads and skid roads should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging roads, and skid roads after the trees are logged helps to establish a protective cover. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and landings and in operating equipment. The roads should be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled.

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

The land capability classification is VIIe. The woodland ordination symbol is 4R. The Michigan soil management group is 1.5a.

31B—Oshtemo sandy loam, 0 to 6 percent slopes. This nearly level to gently sloping, well drained soil is on broad flats, low knolls, and ridges. Individual areas are irregular in shape and range from 3 to 600 acres in size.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, very friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of 80 inches is yellowish brown gravelly sand. In some areas sand and gravel are within a depth of 40 inches. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Brady soils and the sandy Spinks soils. Brady soils are slightly lower on the landscape than the Oshtemo soil. Spinks soils are in landscape positions similar to those of the Oshtemo soil. Included soils make up 2 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Oshtemo soil and very rapid in the underlying gravelly sand. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is fairly well suited to such crops as corn, soybeans, and winter wheat. The major management concerns are water erosion, soil blowing, droughtiness, and the organic matter content. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface helps to control water erosion and soil blowing and conserves moisture. Buffer strips or field windbreaks help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

This soil is well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil generally is well suited to building site development and septic tank absorption fields. No major management concerns affect these uses. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The land capability classification is IIIs. The woodland ordination symbol is 4A. The Michigan soil management group is 3a.

31C—Oshtemo sandy loam, 6 to 12 percent slopes. This moderately sloping and gently rolling, well drained soil is on side slopes, low knolls, and ridges. Individual areas are irregular in shape and range from 3 to 400 acres in size.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, very friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of 80 inches is yellowish brown gravelly sand. In some areas sand and gravel are within a depth of 40 inches. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Brady soils and the sandy Spinks soils. Brady soils are in depressions and drainageways. Spinks soils are in landscape positions similar to those of the Oshtemo soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of the Oshtemo soil and very rapid in the underlying sand and gravel. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is fairly well suited to such crops as corn and soybeans. The major management concerns are water erosion, soil blowing, droughtiness, and the organic matter content. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface helps to control water erosion and soil blowing and conserves moisture. Buffer strips or field windbreaks help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

This soil is well suited to pasture. The major management concerns are water erosion, droughtiness, and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to water erosion and soil blowing. Proper stocking rates, pasture rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

Because of the slope, this soil is only fairly well suited to septic tank absorption fields and 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. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Pressurized sewage distribution systems also can help to overcome the slope.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 3a.

31D—Oshtemo sandy loam, 12 to 18 percent slopes. This rolling, well drained soil is on side slopes, knolls, and ridges. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, very friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of about 80 inches is yellowish brown gravelly sand. In some areas sand and gravel are within a depth of 40 inches. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Brady soils and the sandy Coloma and Spinks soils. Brady soils are in depressions and drainageways. Coloma soils are excessively drained. Coloma and Spinks soils are in landscape positions similar to those of the Oshtemo soil. Also included are some areas of the moderately steep and steep Oshtemo soils along lakes, swamps, and perennial drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of this Oshtemo soil and very rapid in the underlying gravelly sand. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as hayland. Some areas are used as pasture or woodland.

This soil is poorly suited to such crops as corn and soybeans. The major management concerns are water erosion, droughtiness, soil blowing, and the organic matter content. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface helps to control water erosion and soil blowing and conserves moisture. Buffer strips or field windbreaks help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

This soil is fairly well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to water erosion and soil blowing. Proper stocking rates, pasture rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

Because of the slope, this soil is poorly 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 most areas. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Pressurized sewage distribution systems also help to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol is 4A. The Michigan soil management group is 3a.

31E—Oshtemo sandy loam, 18 to 40 percent slopes. This hilly and steep, well drained soil is on side slopes, high knolls, and ridges. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, very friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of about 80 inches is yellowish brown gravelly sand. In some areas sand and gravel are within a depth of 40 inches. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Brady soils and the sandy Coloma and Spinks soils. Brady soils are in depressions and drainageways. Coloma soils are excessively drained. Coloma and Spinks soils are in landscape positions similar to those of the Oshtemo soil. Also included, around lakes and swamps and along rivers, are some areas of Oshtemo soils that have slopes of more than 40 percent. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of this Oshtemo soil and very rapid in the underlying gravelly sand. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as woodland or pasture. Some of the acreage is idle land.

Because of the slope and the hazard of water erosion, this soil generally is unsuitable as cropland and pasture. A permanent cover of vegetation, such as perennial grasses or trees, helps to control runoff and erosion.

If this soil is used as woodland, the erosion hazard and the equipment limitation are management concerns. Because of the erosion hazard, logging roads and skid roads should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging roads, and skid roads after the trees are logged helps to establish a protective cover. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and landings and in operating equipment. The roads should be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. The use of equipment is briefly restricted in spring and in other excessively wet periods. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled.

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

The land capability classification is VIIe. The woodland ordination symbol is 4R. The Michigan soil management group is 3a.

32—Palms muck. This nearly level or slightly depressional, very poorly drained, organic soil is in swamps, along waterways, and in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is black muck about 11 inches thick. The subsoil is black, friable muck about 21 inches thick. The substratum to a depth of about 60 inches is gray loam and greenish gray silt loam. In some areas it is sandy or marly. In other areas the organic material is more than 50 inches thick.

Included with this soil in mapping are small areas of the loamy Sloan soils along perennial streams. These soils make up 5 to 10 percent of the unit.

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

Most areas of this soil support wetland shrubs or marsh grasses. Some areas are used as cropland or unimproved pasture.

Because ponding is a hazard and most areas do not have adequate outlets for drainage, this soil generally is unsuitable as cropland. In areas where outlets are available, however, the soil can be drained and such crops as corn and soybeans or specialty crops, such as potatoes, carrots, onions, and mint, can be grown. The major management concerns are wetness and soil blowing. Ditches and subsurface drains can lower the water table and reduce the hazard of ponding. Field windbreaks, buffer strips, and winter cover crops help to control soil blowing.

This soil is poorly suited to pasture. The major management concerns are the wetness and the hazard of ponding. Planting reed canarygrass and other forage species that are water tolerant and resistant to heaving can help to maintain the plant cover. Where adequate outlets are available, surface drains can reduce the wetness and the hazard of ponding. Proper stocking rates, pasture rotation, and restricted use during wet periods are needed.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are the major management concerns. The use of heavy equipment is limited because of the wetness and the strength in the organic material. Ordinary crawler tractors or rubber-tired skidders generally cannot be used on this soil. Special harvesting equipment is needed. The equipment should be used only when the soil is frozen. Because of the wetness and the resulting seedling mortality, trees are generally not planted on this soil. Because of the high water table, the trees growing on the soil are shallow rooted. Many may be blown down by high winds. Windthrow can be minimized by harvest methods that do not isolate the remaining trees or leave them widely spaced. Windthrown trees should be removed periodically.

Because of the wetness, the hazard of ponding, and low strength in the organic material, this soil is generally unsuited to building site development and septic tank absorption fields. Soils that are better suited to these uses generally are nearby.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan management group is M/3c.

33—Parkhill loam. This nearly level, poorly drained soil is on low flats and in slight depressions. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is about 17 inches thick. It is mottled. The upper part is gray, firm clay loam and silty clay loam, and the lower part is grayish brown, firm loam. The substratum to a depth of about 60 inches is grayish brown, mottled loam. In some places the surface layer is more than 8 inches thick. In other places the subsoil contains more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Capac soils and small areas of Colwood soils. Capac soils are slightly higher on the landscape than the Parkhill soil. Colwood soils are underlain by stratified material. They are in landscape positions similar to those of the Parkhill soil. Included soils make up 5 to 10 percent of the unit.

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

Most areas are used as cropland. Some areas are used as pasture or are idle.

If drained, this soil is well suited to such crops as corn, soybeans, and winter wheat. The major management concerns are wetness and tilth. If adequate outlets are available, a combination of surface drains and subsurface tile drains is effective in removing excess water. The soil tends to puddle and crust after heavy rains. Tilling when the soil is too wet can alter soil structure and result in cloddiness and compaction. Applying a system of conservation tillage, returning crop residue to the soil, and growing green manure crops improve tilth.

If drained, this soil is well suited to pasture. The major management concerns are wetness, ponding, and compaction. 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. A suitable legume-grass seeding mixture, such as one that includes birdsfoot trefoil, smooth bromegrass, and timothy, provides a long-lived stand that has a long grazing season. If adequate outlets are available, surface drains can remove excess water.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are major management concerns. The use of heavy equipment is restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is frozen or nearly dry. Because of the wetness and the resulting seedling mortality, trees generally are not planted on this soil. Because of the high water table, the trees growing on the soil are shallow rooted. Many may be blown down by high winds. Harvest methods that do not leave the remaining trees widely spaced can reduce the hazard of windthrow. Windthrown trees should be removed periodically.

Because of the hazard of ponding, this soil is generally unsuited to building site development. It is generally unsuited to septic tank absorption fields because of the hazard of ponding and the moderately slow permeability.

The land capability classification is IIw. The woodland ordination symbol is 3W. The Michigan soil management group is 2.5c.

36—Sebewa loam, loamy substratum. This nearly level, poorly drained soil is on broad flats and in depressions. It is subject to ponding. Individual areas are irregular in shape and range from 3 to 160 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsurface layer is grayish brown, mottled loam about 2 inches thick. The subsoil is about 19 inches thick. It is mottled. The upper part is gray, very firm silty clay loam, and the lower part is dark gray, firm sandy clay loam. The upper part of the substratum is yellowish brown, coarse sand. The next part is yellowish brown silty clay loam. The lower part to a depth of about 60 inches is dark brown silty clay loam. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Matherton soils in the slightly higher landscape positions. These soils make up about 5 percent of the unit.

Permeability is moderate in the upper part of the Sebewa soil, rapid in the next part, and slow in the part of the substratum that is silty clay loam. The available water capacity is moderate. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from early fall to late spring.

Most areas are used as cropland. Some areas are used as pasture or are idle.

If drained, this soil is well suited to such crops as corn, soybeans, and winter wheat. The major management concerns are wetness and tilth. If adequate outlets are available, a combination of surface drains and subsurface tile drains is effective in removing excess water. The soil tends to puddle and crust after heavy rains. Tilling when the soil is too wet can alter soil structure and result in cloddiness and compaction. Applying a system of conservation tillage, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. The major management concerns are wetness, ponding, and compaction. 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. A suitable legume-grass seeding mixture, such as one that includes birdsfoot trefoil, smooth bromegrass, and timothy, provides a long-lived stand that has a long grazing season. If adequate outlets are available, surface drains can remove excess water.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are major management concerns. The use of heavy equipment is restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is frozen or nearly dry. Because of the wetness and the resulting seedling mortality, trees generally are not planted on this soil. Because of the high water table, the trees growing on the soil are shallow rooted. Many may be blown down by high winds. Harvest methods that do not leave the remaining trees widely spaced can reduce the hazard of windthrow. Windthrown trees should be removed periodically.

Because of the hazard of ponding, this soil generally is unsuited to building site development and septic tank absorption fields. A poor filtering capacity further limits the use of this soil as a site for septic tank absorption fields.

The land capability classification is IIw. The woodland ordination symbol is 2W. The Michigan soil management group is 3/5c.

37B—Selfridge loamy sand, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on broad flats, in slight depressions, and on low knolls. Individual areas are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface layer is dark brown loamy sand about 7 inches thick. The subsurface layer is mottled sand about 11 inches thick. The upper part is yellowish brown, and the lower part is brown. The subsoil is about 29 inches thick. It is mottled. The upper part is yellowish brown, friable loamy fine sand, and the lower part is brown, firm clay loam and sandy clay loam. The substratum to a depth of about 60 inches is brown, mottled loam. In other areas the subsoil contains more clay. In some areas the sandy upper part of the soil is less than 20 inches thick.

Included with this soil in mapping are small areas of the sandy Thetford soils. These soils are in landscape positions similar to those of the Selfridge soil. They make up 5 to 10 percent of the unit.

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

Most areas are used as cropland. Some of the acreage is idle land.

This soil is fairly well suited to such crops as corn, soybeans, and winter wheat. The major management concerns are water erosion, wetness, soil blowing, and the organic matter content. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion and soil blowing. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing. A combination of surface and subsurface drains is effective in removing excess water. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Returning crop residue to the soil and growing green manure crops increase the organic matter content.

This soil is well suited to pasture. The major management concerns are wetness and overgrazing. Overgrazing and grazing when the soil is excessively wet can damage the plant cover and reduce the quality of the forage. Proper stocking rates, rotation or strip grazing, and restricted use during excessively wet periods help to keep the pasture in good condition and help to control water erosion. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, provides a long-lived stand that has a long grazing season. A surface or subsurface drainage system can be effective in removing excess water.

If this soil is used as woodland, the equipment limitation is a management concern. The use of heavy equipment is briefly restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is frozen or nearly dry.

Because of the wetness, this soil is poorly suited to building site development and septic tank absorption fields. Additions of well compacted fill material can raise the level of building sites. Surface or subsurface drains help to lower the water table. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. Filling or mounding with suitable soil material can raise sites for absorption fields a sufficient distance above the seasonal high water table.

The land capability classification is IIIe. The woodland ordination symbol is 6W. The Michigan soil management group is 4/2b.

39—Sloan loam, sandy substratum. This nearly level, very poorly drained soil is on flood plains along rivers and streams. It is frequently flooded. Individual areas are long and narrow or irregular in shape and range from 3 to 350 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown loam about 20 inches thick. The subsoil is about 14 inches thick. It is mottled. The upper part is dark gray, firm, stratified clay loam and sandy loam, and the lower part is dark grayish brown, friable sandy loam. The next layer is black, friable sandy loam about 14 inches thick. The substratum to a depth of about 60 inches is dark gray sand. In some areas the surface layer is muck. In other areas the soil contains less clay.

Included with this soil in mapping are small areas of Houghton and Palms soils in depressions on the flood plains. Houghton soils consist of muck more than 51 inches thick. Palms soils consist of muck 16 to 51 inches deep over loamy material. Included soils make up about 10 percent of the unit.

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

Most areas support native wetland vegetation, including trees and brush. Because of the wetness and the hazard of flooding, this soil generally is unsuitable as cropland and is poorly suited to pasture. Where adequate outlets are available, surface drains can reduce the wetness in pastured areas. Planting reed canarygrass and other water-tolerant forage species helps to maintain the plant cover. Proper stocking rates, pasture rotation, and restricted use during wet periods are needed.

If this soil is used as woodland, the equipment limitation, the seedling mortality rate, and the windthrow hazard are major management concerns. The use of heavy equipment is limited by the frequent flooding. The equipment should be used only when the soil is frozen or nearly dry. Special site preparation, such as bedding and furrowing, is needed to lower the seedling mortality rate. Because of the high water table, the trees growing on the soil are shallow rooted. Some may be blown down by high winds. Harvest methods that do not leave the remaining trees widely spaced can reduce the hazard of windthrow. Windthrown trees should be removed periodically.

This soil generally is unsuited to building site development and septic tank absorption fields because of the wetness and the hazard of flooding.

The land capability classification is Vw. The woodland ordination symbol is 3W. The Michigan soil management group is L-2c.

40B—Spinks loamy sand, 0 to 6 percent slopes. This nearly level to gently sloping, well drained soil is on broad flats, low knolls, and ridges. Individual areas are irregular in shape and range from 3 to 400 acres in size.

Typically, the surface layer is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown, very friable sand about 17 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas the bands of loamy sand have a total thickness of less than 6 inches.

Included with this soil in mapping are small areas of the loamy Oshtemo and Tekenink soils. Oshtemo soils are underlain by sand and gravel below a depth of 40 inches. Both of the included soils are in landscape positions similar to those of the Spinks soil. They make up 10 to 15 percent of the unit.

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

Most areas are used as cropland. Some areas are used as woodland or pasture.

This soil is fairly well suited to such crops as corn, soybeans, and winter wheat. The major management concerns are droughtiness, soil blowing, and the organic matter content. Returning crop residue to the soil and planting green manure crops increase the organic matter content and the available water capacity. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface conserves moisture and helps to control soil blowing. Fall-seeded crops, such as winter wheat or rye, and small grain seeded in early spring can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing.

This soil is well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil generally is well suited to building site development and septic tank absorption fields. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The land capability classification is IIIs. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

40C—Spinks loamy sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on side slopes, low knolls, and ridges. Individual areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown, very friable sand about 17 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas the bands of loamy sand have a total thickness of less than 6 inches.

Included with this soil in mapping are small areas of the loamy Oshtemo and Tekenink soils. Oshtemo soils are underlain by sand and gravel below a depth of 40 inches. Both of these included soils are in landscape positions similar to those of the Spinks soil. They make up 10 to 15 percent of the unit.

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

Most areas are used as cropland. Some areas are used as woodland or pasture.

This soil is fairly well suited to such crops as corn and soybeans. The major management concerns are droughtiness, soil blowing, water erosion, and the organic matter content. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface conserves moisture and helps to control water erosion and soil blowing. Cropping systems that include close-growing crops, such as hay and small grain, also help to control water erosion and soil blowing. Fall-seeded crops, such as winter wheat or rye, and small grain seeded in early spring can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing.

This soil is well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to water erosion and soil blowing. Proper stocking rates, pasture rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

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. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. Installing the distribution lines across the slope helps to ensure that the septic tank absorption fields function properly. Pressurized sewage distribution systems also can help to overcome the slope.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

40D—Spinks loamy sand, 12 to 18 percent slopes. This 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 loamy sand about 11 inches thick. The subsurface layer is yellowish brown, very friable sand about 17 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas the bands of loamy sand have a total thickness of less than 6 inches.

Included with this soil in mapping are small areas of the loamy Oshtemo and Tekenink soils. Oshtemo soils are underlain by sand and gravel below a depth of 40 inches. Both of these included soils are in landscape positions similar to those of the Spinks soil. Also included are some areas of the moderately steep and steep Spinks soils around lakes and swamps and along rivers. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in this Spinks soil. The available water capacity is low. Surface runoff is medium.

Most areas are used as hayland. Some areas are used as pasture or cropland.

This soil is poorly suited to such crops as corn and soybeans. The major management concerns are water erosion, soil blowing, droughtiness, and the organic matter content. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion and soil blowing and conserves moisture. Fall-seeded crops, such as winter wheat or rye, and small grain seeded in early spring can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips and applying a system of rough tillage help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

This soil is fairly well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and can greatly increase the susceptibility to water erosion and soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

Because of the slope, this soil is poorly 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. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Pressurized sewage distribution systems also help to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

40E—Spinks loamy sand, 18 to 40 percent slopes. This hilly and steep, well drained soil is on side slopes, high 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 loamy sand about 11 inches thick. The subsurface layer is yellowish brown, very friable sand about 17 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas the bands of loamy sand have a total thickness of less than 6 inches.

Included with this soil in mapping are small areas of the loamy Oshtemo and Tekenink soils. Oshtemo soils are underlain by sand and gravel at a depth of more than 40 inches. Both of these included soils are in landscape positions similar to those of the Spinks soil. Also included, along depressions and drainageways, are some areas of Spinks soils that have slopes of more than 40 percent. Included soils make up 10 to 15 percent of the unit.

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

Most areas are used as woodland. Some areas are used as pasture or are idle.

Because of the slope and the hazard of water erosion, this soil generally is unsuitable as cropland and pasture. In areas where the slope is more than 25 percent, a permanent plant cover is needed to minimize the erosion hazard.

If this soil is used as woodland, the erosion hazard and the equipment limitation are management concerns. Because of the erosion hazard, logging roads, skid roads, and landings should be established on gentle grades and water should be removed by water bars, culverts, and drop structures. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and landings and in operating equipment. The roads should be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. Seeding skid roads, logging roads, and landings after the trees are logged helps to control erosion. Year-round logging roads should be graveled.

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

The land capability classification is VIIe. The woodland ordination symbol is 4R. The Michigan soil management group is 4a.

47B—Perrinton loam, moderately wet, 1 to 8 percent slopes. This nearly level to gently rolling, moderately well drained soil is on low knolls and ridges. Individual areas are irregular in shape and range from 3 to 180 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The next 6 inches is dark brown, mottled, firm silty clay loam mixed with light brownish gray loam. The subsoil is dark brown, mottled, firm silty clay about 12 inches thick. The substratum to a depth of about 60 inches is brown, mottled silty clay loam. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Ithaca and poorly drained Lenawee soils. Ithaca soils are slightly lower on the landscape than the Perrinton soil. Lenawee soils are in depressions. Included soils make up 10 to 15 percent of the unit.

Permeability is slow in the Perrinton soil. The available water capacity is high. Surface runoff is medium. The seasonal high water table is at a depth of 2.5 to 6.0 feet from early fall to early spring. Because of the slow permeability, water is temporarily perched in the surface layer during spring and after heavy rains.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concerns are water erosion, wetness, and tilth. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control water erosion. A combination of surface drains and subsurface tile drains is effective in removing excess water. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Minimizing tillage and tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. Grazing when the soil is excessively wet can cause compaction, damage the plant cover, and increase the runoff rate. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition and help to control water erosion. A suitable legume-grass seeding mixture, such as one that includes alfalfa and timothy, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil is fairly well suited to building site development. The shrink-swell potential, the wetness, and the slope are moderate limitations. Widening the foundation trenches and backfilling with suitable fill material help to prevent the structural damage caused by shrinking and swelling. The buildings should be constructed on well compacted fill material, which raises the level of the site. The soil generally is unsuited to septic tank absorption fields because of the wetness and the slow permeability.

The land capability classification is IIe. The woodland ordination symbol is 4A. The Michigan soil management group is 1.5a.

50B—Kibbie silt loam, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is on broad flats and in slight depressions. Individual areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil is about 15 inches thick. It is mottled and firm. The upper part is light olive brown clay loam, and the lower part is yellowish brown silty clay loam. The substratum to a depth of about 60 inches is light olive brown, mottled, stratified silty clay loam, silt loam, and silt. In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Capac and Colwood soils. Capac soils are not stratified. They are in landscape positions similar to those of the Kibbie soil. Colwood soils are poorly drained and are in depressions on broad flats. Included soils make up 5 to 10 percent of the unit.

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

Most areas are used as cropland. Some areas are used as pasture.

This soil is well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concerns are water erosion, wetness, and tilth. Cropping systems that include close-growing crops, such as hay and small grain, and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control water erosion. A combination of surface drains and subsurface tile drains is effective in removing excess water. Suitable filtering material is needed around the tile lines to prevent the flow of silt into the lines. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Minimizing tillage, tilling at the proper soil moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. The major management concerns are wetness, overgrazing, and soil 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. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, provides a long-lived stand that has a long grazing season. A surface and subsurface drainage system can be effective in removing excess water.

If this soil is used as woodland, the equipment limitation is a major management concern. The use of heavy equipment is briefly restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is frozen or nearly dry.

Because of the wetness, this soil is poorly suited to building site development and septic tank absorption fields. Building sites should be raised through additions of well compacted fill. Surface or subsurface drains help to lower the water table. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. Filling or mounding with suitable soil material can raise the absorption fields a sufficient distance above the seasonal high water table.

The land capability classification is IIe. The woodland ordination symbol is 4W. The Michigan soil management group is 2.5b-s.

51A—Marlette fine sandy loam, moderately wet, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on broad flats. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The next 16 inches is pale brown, mottled, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, mottled, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In some areas the subsoil contains more clay. In other areas the substratum is sandy below a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Capac and poorly drained Parkhill soils. Capac soils are in slight depressions. Parkhill soils are in the lower depressions. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Marlette soil. The available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 2.5 to 6.0 feet from late fall to early spring. Because of the moderately slow permeability, water is temporarily perched in the surface layer during spring and after heavy rains.

Most areas are used as cropland. Some areas are used as pasture.

This soil is well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concerns are soil blowing and the organic matter content. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content.

This soil is well suited to pasture. Grazing when the soil is excessively wet can cause compaction and damage the plant cover. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods can help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil is fairly well suited to building site development. It is generally unsuited to septic tank absorption fields because of the wetness and the moderately slow permeability. The wetness is the major limitation on sites for buildings with basements. The buildings should be constructed on well compacted fill material, which can raise the level of the site. Surface or subsurface drains help to lower the water table.

The land capability classification is I. The woodland ordination symbol is 3A. The Michigan soil management group is 2.5a.

51B—Marlette fine sandy loam, moderately wet, 2 to 8 percent slopes. This gently undulating to gently rolling, moderately well drained soil is on low knolls and ridges. Individual areas are irregular in shape and range from 3 to 1,000 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The next 16 inches is pale brown, mottled, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, mottled, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled loam. In some areas the subsoil contains more clay. In other areas the substratum is sandy below a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Capac and poorly drained Parkhill soils. Capac soils are in slight depressions. Parkhill soils are in the lower depressions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Marlette soil. The available water capacity is high. Surface runoff is medium. The seasonal high water table is at a depth of 2.5 to 6.0 feet from late fall to early spring. Because of the moderately slow permeability, water is temporarily perched in the plow layer during spring and after heavy rains.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concerns are water erosion, soil blowing, and the organic matter content. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content.

This soil is well suited to pasture. Grazing when the soil is excessively wet can cause compaction and can increase the runoff rate. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If the soil is used as woodland, there are no major management concerns.

This soil is fairly well suited to building site development. It is generally unsuited to septic tank absorption fields because of the wetness and the moderately slow permeability. The wetness is the major limitation on sites for buildings with basements. The buildings should be constructed on well compacted fill material, which can raise the level of the site. Surface or subsurface drains help to lower the water table.

The land capability classification is IIe. The woodland ordination symbol is 3A. The Michigan soil management group is 2.5a.

53—Pits. This map unit consists of open excavations from which soil and the underlying sand or gravel have been removed. The exposed soil material in the bottom of the pit may be bare or may support some vegetation. The outer edges of these excavations have steep side slopes. Many areas have been excavated to a depth below the water table. Individual areas are square, rectangular, or irregular in shape and range from 3 to 200 acres in size.

Some areas are mined. Others have been abandoned. This unit is generally unsuitable as cropland, pasture, and woodland. It generally is poorly suited to building site development. Onsite investigation is needed to determine specific soil properties.

This map unit is not assigned to interpretive groups.

55—Algansee loamy fine sand. This nearly level, somewhat poorly drained soil is on benches and terraces above the first bottoms of flood plains along rivers and streams. It is occasionally flooded. Individual areas are long and narrow or irregular in shape and range from 3 to 110 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 12 inches thick. The substratum extends to a depth of 60 inches or more. In sequence downward, it is yellowish brown, mottled, loose fine sand; dark brown, mottled, very friable loamy fine sand; light yellowish brown and yellowish brown, mottled, loose sand and fine sand; and light yellowish brown, mottled, very friable, stratified loamy fine sand and loamy very fine sand. In some areas the substratum has layers of sandy loam.

Included with this soil in mapping are small areas of the very poorly drained Glendora and Sloan soils in depressions and drainageways. These soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Algansee soil. The available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 1 to 2 feet from early fall to early spring.

Most areas are used as woodland. Some areas are used as parks or pasture.

This soil is fairly well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concerns are seasonal wetness, seasonal droughtiness, soil blowing, and the organic matter content. A combination of surface drains and subsurface tile drains is effective in removing excess water. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control soil blowing and conserve moisture. Fall-seeded crops, such as winter wheat and rye, and small grain seeded in early spring can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

This soil is well suited to pasture. The major management concerns are wetness and overgrazing. Overgrazing or grazing when the soil is wet can destroy the cover of forage plants. Proper stocking rates, pasture rotation, and restricted use during excessively wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, provides a long-lived stand that has a long grazing season. A surface and subsurface drainage system can be effective in removing excess water.

If this soil is used as woodland, the equipment limitation is a major management concern. The use of heavy equipment is limited by the occasional flooding and the wetness in late fall and early spring. The equipment should be used only when the soil is frozen or nearly dry.

Because of the wetness and the hazard of flooding, this soil is generally unsuited to building site development and septic tank absorption fields.

The land capability classification is IIIw. The woodland ordination symbol is 4W. The Michigan soil management group is L-4c.

56A—Thetford loamy sand, 0 to 3 percent slopes. This nearly level or very gently sloping, somewhat poorly drained soil is on flats, low knolls, and low ridges. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsoil is about 54 inches thick. In sequence downward, it is yellowish brown loamy sand and light yellowish brown, mottled sand; light yellowish brown, mottled, very friable sand that has bands of strong brown loamy sand; very pale brown, mottled, very friable sand that has bands of yellowish red loamy sand; and light yellowish brown, friable sand that has bands of yellowish red sandy loam. In some areas the bands have a total thickness of less than 6 inches.

Included with this soil in mapping are small areas of the loamy Brady and Selfridge soils. Brady soils are underlain by sand and gravel below a depth of 40 inches. Selfridge soils are loamy in the lower part of the subsoil. Both of these included soils are in landscape positions similar to those of the Thetford soil. They make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Thetford soil. The available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 1 to 2 feet from late winter to early spring.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is fairly well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concerns are seasonal wetness, seasonal droughtiness, soil blowing, and the organic matter content. A combination of surface drains and subsurface tile drains is effective in removing excess water. Erosion-control structures may be needed at the outlet of surface ditches. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control soil blowing and conserve moisture. Fall-seeded crops, such as winter wheat and rye, can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

This soil is well suited to pasture. The major management concerns are wetness and overgrazing. Overgrazing or grazing when the soil is excessively 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. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, provides a long-lived stand that has a long grazing season. A surface or subsurface drainage system can be effective in removing excess water.

If this soil is used as woodland, the equipment limitation is a management concern. The use of heavy equipment is briefly restricted in the spring and in other excessively wet periods. The equipment should be used only when the soil is frozen or nearly dry.

Because of the wetness, this soil is poorly suited to building site development and septic tank absorption fields. Surface or subsurface drains help to lower the water table. The buildings can be constructed on well compacted fill material, which raises the level of the site. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. Filling or mounding with suitable soil material can raise sites for the absorption fields a sufficient distance above the seasonal high water table.

The land capability classification is IIIw. The woodland ordination symbol is 3W. The Michigan soil management group is 4b.

57B—Coloma loamy sand, 0 to 6 percent slopes. This nearly level to gently sloping, excessively drained soil is on broad flats, low knolls, and ridges. Individual areas are long and narrow or irregular in shape and range from 3 to 800 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Included with this soil in mapping are small areas of Boyer and Oshtemo soils, which are underlain by stratified sand and gravel. Both of these included soils are in landscape positions similar to those of the Coloma soil. They make up 5 to 15 percent of the unit.

Permeability is rapid in the Coloma soil. The available water capacity is low. Surface runoff is very slow.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is poorly suited to such crops as corn and soybeans. The major management concerns are droughtiness, soil blowing, and the organic matter content. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface conserve moisture and help to control soil blowing. Fall-seeded crops, such as winter wheat and rye, and small grain seeded in early spring can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing.

This soil is fairly well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

This soil is generally well suited to building site development and fairly well suited to septic tank absorption fields. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water supplies. Pressurized sewage distribution systems can achieve uniform discharge rates from all points in the absorption field. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IVs. The woodland ordination symbol is 2A. The Michigan soil management group is 4a.

57C—Coloma loamy sand, 6 to 12 percent slopes. This moderately sloping and gently rolling, excessively drained soil is on side slopes, low knolls, and ridges. Individual areas are irregular in shape and range from 3 to 460 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The surface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Included with this soil in mapping are small areas of Boyer and Oshtemo soils, which are underlain by stratified sand and gravel. Both of these included soils are in landscape positions similar to those of the Coloma soil. They make up 5 to 15 percent of the unit.

Permeability is rapid in the Coloma soil. The available water capacity is low. Surface runoff is slow.

Most areas are used as cropland. Some areas are used as pasture or woodland or are idle.

Because of droughtiness, the hazard of soil blowing, and the slope, this soil generally is unsuited to cropland. If good management is applied, however, such crops as corn and soybeans can be grown. Growing green manure crops and regularly adding other organic material to the soil increase the available water capacity. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface conserve moisture and help to control soil blowing. Fall-seeded crops, such as winter wheat and rye, and small grain seeded in early spring can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing.

This soil is poorly suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to soil blowing and water erosion. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

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. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The slope and a poor filtering capacity are limitations on sites for septic tank absorption fields. This soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Pressurized sewage distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that ground water will be polluted.

The land capability classification is VIs. The woodland ordination symbol is 2A. The Michigan soil management group is 4a.

57D—Coloma loamy sand, 12 to 18 percent slopes. This rolling, excessively drained soil is on side slopes, knolls, and ridges. Individual areas are irregular in shape and range from 3 to 300 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Included with this soil in mapping are small areas of Boyer and Oshtemo soils, which are underlain by stratified sand and gravel. Both of these included soils are in landscape positions similar to those of the Coloma soil. Also included are areas of the steep and very steep Coloma soils around lakes and swamps and along streams. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Coloma soil. The available water capacity is low. Surface runoff is slow.

Most areas are used as woodland or are idle. Some areas are used as pasture. Because of droughtiness, the hazard of soil blowing, and the slope, this soil generally is unsuitable as cropland. It is poorly suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to soil blowing and water erosion. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, there are no major management concerns.

Because of the slope, this soil is poorly 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. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The slope and a poor filtering capacity are limitations on sites for septic tank absorption fields. This soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. Pressurized sewage distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is VIs. The woodland ordination symbol is 2A. The Michigan soil management group is 4a.

57E—Coloma loamy sand, 18 to 40 percent slopes. This hilly and steep, excessively drained soil is on side slopes, high knolls, and ridges. Individual areas are irregular in shape and range from 3 to 140 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Included with this soil in mapping are small areas of Boyer and Oshtemo soils, which are underlain by stratified sand and gravel. Both of these included soils are in landscape positions similar to those of the Coloma soil. Also included, around lakes and swamps and along streams, are areas of Coloma soils that have slopes of more than 40 percent. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Coloma soil. The available water capacity is low. Surface runoff is medium.

Most areas are used as woodland or are idle. Some areas are used as pasture. Because of the slope and the hazard of water erosion, this soil generally is unsuitable as cropland or pasture.

If this soil is used as woodland, the erosion hazard, the equipment limitation, and the seedling mortality rate are management concerns. Because of the erosion hazard, logging roads and skid roads should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging roads, and skid roads after the trees are logged helps to establish a protective cover. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and landings and in operating equipment. The roads should be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. Droughtiness reduces the seedling survival rate. Planting containerized seedlings or other special nursery stock can reduce the seedling mortality rate. Special harvest methods that leave some mature trees to provide shade and protection for the seedlings may be desirable.

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

The land capability classification is VIIs. The woodland ordination symbol is 2R. The Michigan soil management group is 4a.

58B—Coloma-Boyer loamy sands, 0 to 6 percent slopes. These nearly level to gently sloping, excessively drained and well drained soils are on flats, low knolls, and ridges. They are underlain by sandy and gravelly material (fig. 10). Individual areas are long and narrow or irregular in shape and range from 5 to 600 acres in size. They are about 60 percent Coloma soil and 32 percent Boyer soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Typically, the Boyer soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the next part is strong brown, friable gravelly sandy loam; and the lower part is dark brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas it is banded sand and loamy sand.

Included with these soils in mapping are small areas of the well drained Kalamazoo soils. These included soils have more clay in the subsoil than the Coloma and Boyer soils. They are in landscape positions similar to those of the Coloma and Boyer soils. They make up 4 to 12 percent of the unit.

Permeability is rapid in the Coloma soil. It is moderately rapid in the upper part of the Boyer soil and very rapid in the lower part. The available water capacity is low in both soils. Surface runoff is slow.

Most areas are used as cropland or pasture. Some areas are used as woodland.

These soils are poorly suited to such crops as corn and soybeans. The major management concerns are soil blowing, droughtiness, and the organic matter content. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control soil blowing and conserve moisture. Fall-seeded crops, such as winter wheat and rye, and small grain seeded in early spring can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

These soils are fairly well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soils are excessively dry can damage the plant cover and can increase the susceptibility to soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If these soils are used as woodland, there are no major management concerns.

These soils generally are well suited to building site development and fairly well suited to septic tank absorption fields. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls

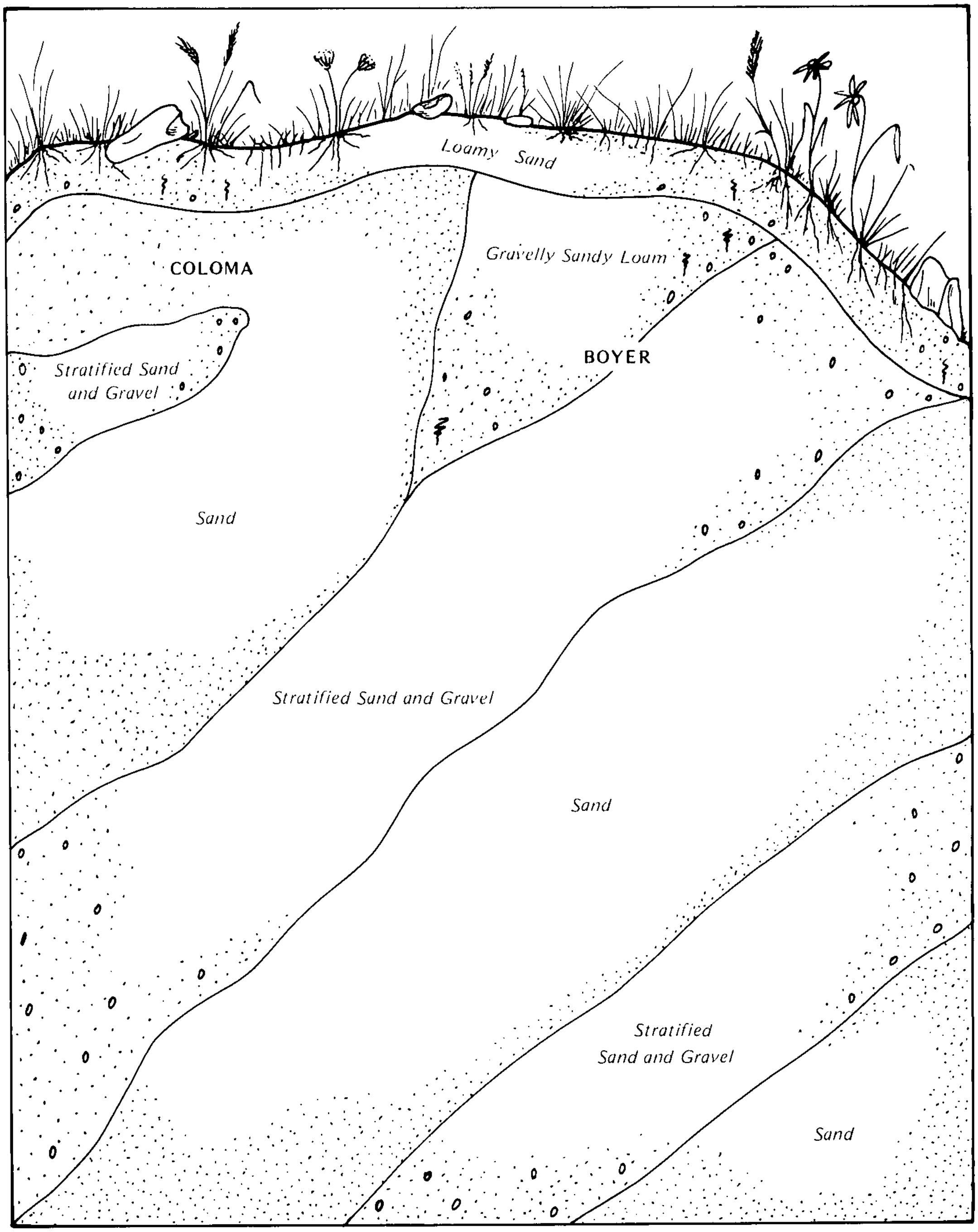

Figure 10.—Typical pattern of the material underlying Coloma and Boyer soils.

helps to overcome this limitation. The soils readily absorb but do not adequately filter the effluent in the absorption fields. The poor filtering capacity may result in the pollution of ground water supplies. Pressurized sewage distribution systems can achieve uniform discharge rates from all points in the absorption field. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IVs. The woodland ordination symbol assigned to the Coloma soil is 2A, and that assigned to the Boyer soil is 4A.

The Michigan soil management group is 4a.

58C—Coloma-Boyer loamy sands, 6 to 12 percent slopes. These moderately sloping and gently rolling, excessively drained and well drained soils are on side slopes, low knolls, and ridges. Individual areas are irregular in shape and range from 5 to 200 acres in size. They are about 60 percent Coloma soil and 32 percent Boyer soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Typically, the Boyer soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the next part is strong brown, friable gravelly sandy loam; and the lower part is dark brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas it is banded sand and loamy sand.

Included with these soils in mapping are small areas of Kalamazoo soils. These included soils are in landscape positions similar to those of the Coloma and Boyer soils. They have more clay in the subsoil than the Coloma and Boyer soils. They make up 4 to 12 percent of the unit.

Permeability is rapid in the Coloma soil. It is moderately rapid in the upper part of the Boyer soil and very rapid in the lower part. The available water capacity is low in both soils. Surface runoff is slow.

Most areas are used as cropland or pasture. Some areas are used as woodland or are idle.

Because of droughtiness, the hazard of soil blowing, and the slope, these soils generally are unsuitable as cropland. If good management is applied, however, such crops as corn and soybeans can be grown. Growing green manure crops and regularly adding other organic material to the soil increase the available water capacity. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface conserve moisture and help to control soil blowing. Fall-seeded crops, such as winter wheat and rye, and small grain seeded in early spring can make good use of the limited supply of available water. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing.

These soils are poorly suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soils are excessively dry can damage the plant cover and increase the susceptibility to soil blowing and water erosion. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long growing season.

If these soils are used as woodland, there are no major management concerns.

Because of the slope, these soils are 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. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

Because of the slope and a poor filtering capacity, these soils are only fairly well suited to septic tank absorption fields. They readily absorb but do not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. Pressurized sewage distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is VIs. The woodland ordination symbol assigned to the Coloma soil is 2A, and that assigned to the Boyer soil is 4A. The Michigan soil management group is 4a.

58D—Coloma-Boyer loamy sands, 12 to 18 percent slopes. These rolling, excessively drained and well drained soils are on side slopes, knolls, and ridges. Individual areas are irregular in shape and range from 5 to 200 acres in size. They are about 60 percent Coloma soil and 32 percent Boyer soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Typically, the Boyer soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the next part is strong brown, friable gravelly sandy loam; and the lower part is dark brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas it is banded sand and loamy sand.

Included with these soils in mapping are small areas of Kalamazoo soils. These included soils are in landscape positions similar to those of the Coloma and Boyer soils. They have more clay in the subsoil than the Coloma and Boyer soils. Also included are areas of the moderately steep and steep Coloma and Boyer soils along lakes, swamps, and streams. Included soils make up 4 to 12 percent of the unit.

Permeability is rapid in the Coloma soil. It is moderately rapid in the upper part of the Boyer soil and very rapid in the lower part. The available water capacity is low in both soils. Surface runoff is slow.

Most areas are used as woodland. Some areas are used as pasture or are idle. Some are used as cropland. Because of droughtiness, the hazard of soil blowing, and the slope, these soils are generally unsuitable as cropland. They are poorly suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soils are excessively dry can damage the plant cover and increase the susceptibility to soil blowing and water erosion. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If these soils are used as woodland, there are no major management concerns.

Because of the slope, these soils are poorly 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. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

Because of the slope and a poor filtering capacity, these soils are poorly suited to septic tank absorption fields. They readily absorb but do not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. Pressurized sewage distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is VIs. The woodland ordination symbol assigned to the Coloma soil is 2A, and that assigned to the Boyer soil is 4A. The Michigan soil management group is 4a.

58E—Coloma-Boyer loamy sands, 18 to 40 percent slopes. These hilly and steep, excessively drained and well drained soils are on side slopes, high knolls, and ridges. Individual areas are irregular in shape and range from 5 to 200 acres in size. They are about 60 percent Coloma soil and 32 percent Boyer soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Typically, the Boyer soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsoil is about 24 inches thick. The upper part is dark yellowish brown, very friable loamy sand; the next part is strong brown, friable gravelly sandy loam; and the lower part is dark brown, firm gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown gravelly sand. In some areas it is banded sand and loamy sand.

Included with these soils in mapping are small areas on high knolls where gravel is at the surface. Also included, along depressions and drainageways, are areas of Coloma and Boyer soils that have slopes of more than 40 percent. Included soils make up 4 to 12 percent of the unit.

Permeability is rapid in the Coloma soil. It is moderately rapid in the upper part of the Boyer soil and very rapid in the lower part. The available water capacity is low in both soils. Surface runoff is medium.

Most areas are used as woodland. Some areas are used as pasture or are idle. Because of the slope and the hazard of water erosion, these soils are generally unsuitable as cropland and pasture.

If these soils are used as woodland, the erosion hazard, the equipment limitation, and the seedling mortality rate are management concerns. Because of the erosion hazard, logging roads and skid roads should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging roads, and skid roads after the trees are logged helps to establish a protective cover. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and landings and in operating equipment. The roads should be designed so that they conform to the topography. The grade should be kept as low as possible. Droughtiness in the surface layer reduces the seedling survival rate on the Coloma soil. Planting containerized seedlings or other special nursery stock can reduce the seedling mortality rate. Special harvest methods that leave some mature trees to provide shade and protection for the seedlings may be desirable.

Because of the slope, these soils are generally unsuited to septic tank absorption fields and building site development.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Coloma soil is 2R, and that assigned to the Boyer soil is 4R. The Michigan soil management group is 4a.

59A—Brems sand, 0 to 3 percent slopes. This nearly level and very gently sloping, moderately well drained soil is on broad flats. Individual areas are irregular in shape and range from 3 to 800 acres in size.

Typically, the surface layer is black sand about 1 inch thick. The next 6 inches is dark brown sand. The subsoil is strong brown, loose sand about 32 inches thick. It is mottled in the lower part. The substratum to a depth of about 60 inches is brownish yellow and light yellowish brown, mottled sand. In some areas bands of loamy sand are in the lower part of the soil.

Included with this soil in mapping are small areas of the sandy, excessively drained Coloma soils on low ridges. These soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Brems soil. The available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 2 to 3 feet in the spring.

Most of the acreage is idle land. Some areas are used as cropland.

This soil is poorly suited to such crops as corn and soybeans. The major management concerns are droughtiness, soil blowing, and the organic matter content. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface conserve moisture and help to control soil blowing. Fall-seeded crops, such as winter wheat or rye, or small grain seeded in early spring can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and the available water capacity.

This soil is fairly well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, pasture rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If this soil is used as woodland, the equipment limitation and the seedling mortality rate are management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Droughtiness in the surface layer reduces the seedling survival rate. Planting containerized seedlings or other special nursery stock can reduce the seedling mortality rate. Special harvest methods that leave some mature trees to provide shade and protection for the seedlings may be desirable.

Because of the seasonal high water table, this soil is only fairly well suited to buildings with basements. It is well suited to buildings without basements. Buildings with basements should be constructed on well compacted fill material, which raises the level of the site. A drainage system can lower the water table. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and a poor filtering capacity. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Installing subsurface drains and mounding or raising the site with suitable fill material help to ensure that the absorption field functions properly. A pressurized sewage distribution system can achieve uniform discharge rates from all points in the absorption field. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IVs. The woodland ordination symbol is 3S. The Michigan soil management group is 5b.

60A—Schoolcraft loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad flats. Individual areas are irregular in shape and range from 3 to 540 acres in size.

Typically, the surface layer is black loam about 10 inches thick. The next 5 inches is mixed black, very dark grayish brown, and dark brown, friable loam. The subsoil is about 35 inches thick. The upper part is dark brown, firm sandy clay loam, and the lower part is dark yellowish brown, friable sandy loam and loamy sand. The substratum to a depth of about 60 inches is strong brown, stratified sand and gravel. In some areas the surface layer is less than 10 inches thick and is lighter colored. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the sandy, excessively drained Coloma soils. These soils are in landscape positions similar to those of the Schoolcraft soil. They make up 2 to 5 percent of the unit.

Permeability is moderate in the upper part of the Schoolcraft soil and rapid in the lower part. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as cropland. Some areas are used as pasture.

This soil is well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concern is tilth. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface conserves moisture and helps to maintain soil structure. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. Grazing when the soil is excessively wet can cause compaction and poor soil structure. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

This soil is well suited to building site development. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. The soil is fairly well 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. Pressurized sewage distribution systems can achieve uniform discharge rates from all points in the absorption field. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IIs. The Michigan soil management group is 2.5/5a. No woodland ordination symbol is assigned.

60B—Schoolcraft loam, 2 to 6 percent slopes. This very gently sloping and gently sloping, well drained soil is in broad areas and on low ridges. Individual areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is black loam about 10 inches thick. The next 5 inches is mixed black, very dark grayish brown, and dark brown, friable loam. The subsoil is about 35 inches thick. The upper part is dark brown, firm sandy clay loam, and the lower part is dark yellowish brown, friable sandy loam and loamy sand. The substratum to a depth of about 60 inches is strong brown, stratified sand and gravel. In some areas the surface layer is less than 10 inches thick and is lighter colored. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the sandy, excessively drained Coloma soils on low ridges. These soils make up 2 to 5 percent of the unit.

Permeability is moderate in the upper part of the Schoolcraft soil and rapid in the lower part. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as cropland. Some areas are used as pasture.

This soil is well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concerns are water erosion and tilth. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface helps to control erosion, conserves moisture, and helps to maintain soil structure. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is well suited to pasture. Grazing when the soil is excessively wet can cause compaction, excessive runoff, and poor soil structure. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long growing season.

This soil is well suited to building site development. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation. The soil is fairly well 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. Pressurized sewage distribution systems can achieve uniform discharge rates from all points in the absorption field. The uniform application of effluent provides for unsaturated flow into the underlying soil and reduces the likelihood that the ground water will be polluted.

The land capability classification is IIe. The Michigan soil management group is 2.5/5a. No woodland ordination symbol is assigned.

63B—Elston sandy loam, 0 to 6 percent slopes. This nearly level to gently sloping, well drained soil is on broad flats. Individual areas are irregular in shape and range from 3 to 250 acres in size.

Typically, the surface layer is black sandy loam about 13 inches thick. The subsurface layer is dark brown and black, friable sandy loam about 5 inches thick. The subsoil is about 42 inches thick. The upper part is dark yellowish brown, friable sandy loam; the next part is dark yellowish brown and yellowish brown, very friable and loose loamy sand; and the lower part is dark yellowish brown, loose loamy sand that has bands of strong brown sandy loam. In some areas the subsoil contains more clay. In other areas the surface layer is less than 10 inches thick and is lighter colored.

Permeability is moderately rapid. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as cropland. Some areas are used as pasture.

This soil is well suited to such crops as corn, soybeans, winter wheat, and alfalfa. The major management concerns are water erosion and soil blowing. Cropping systems that include close-growing crops, such as hay and small grain, can help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion and soil blowing and conserves moisture. Buffer strips and field windbreaks help to control soil blowing.

This soil is well suited to pasture. The major management concern is overgrazing. Overgrazing or grazing when the soil is excessively dry can damage the plant cover and increase the susceptibility to soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during dry periods help to keep the pasture in good condition and help to control soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

This soil is well suited to building site development and septic tank absorption fields. Some land shaping may be necessary on building sites. The caving of cutbanks is a limitation in shallow excavations. Reinforcing the trench walls helps to overcome this limitation.

The land capability classification is IIe. The Michigan soil management group is 3a. No woodland ordination symbol is assigned.

67B—Marlette-Oshtemo complex, 0 to 6 percent slopes. These nearly level to undulating, well drained soils are on low knolls and ridges. Individual areas are irregular in shape and range from 5 to 160 acres in size. They are about 45 to 50 percent Marlette soil and 40 to 45 percent Oshtemo soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Marlette soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil contains more clay. In other areas the substratum is sandy below a depth of 40 inches.

Typically, the Oshtemo soil has a surface layer of dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, very friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of about 80 inches is yellowish brown gravelly sand. In some areas sand and gravel are within a depth of 40 inches. In other areas the subsoil contains more clay.

Included with these soils in mapping are small areas of the sandy, excessively drained Coloma soils and the sandy, well drained Spinks soils. These included soils are in landscape positions similar to those of the Marlette and Oshtemo soils. They make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Marlette soil. It is moderately rapid in the upper part of the Oshtemo soil and very rapid in the underlying gravelly sand. The available water capacity is high in the Marlette soil and moderate in the Oshtemo soil. Surface runoff is medium on the Marlette soil and slow on the Oshtemo soil.

Most areas are used as cropland. Some areas are used as pasture or woodland.

These soils are well suited to such crops as corn and soybeans. The major management concerns are water erosion, soil blowing, and tilth. Cropping systems that include close-growing crops, such as hay and small grain, can help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion and soil blowing. Buffer strips and field windbreaks help to control soil blowing. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

These soils are well suited to pasture. Grazing when the soils are excessively wet can cause compaction, damage the plant cover, and increase the susceptibility to water erosion and soil blowing. Proper stocking rates, rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If these soils are used as woodland, there are no major management concerns.

These soils generally are well suited to building site development. The caving of cutbanks is a limitation in shallow excavations in areas of the Oshtemo soil. Reinforcing the trench walls helps to overcome this limitation. The Marlette soil is poorly suited to septic tank absorption fields because of the moderately slow permeability. Pressurized distribution systems can achieve uniform discharge rates from all points in the absorption field and help to overcome the restricted permeability. Enlarging the absorption field also helps to overcome this limitation.

The land capability classification is IIe. The woodland ordination symbol assigned to the Marlette soil is 3A, and that assigned to the Oshtemo soil is 4A. The Michigan soil management group assigned to the Marlette soil is 2.5a, and that assigned to the Oshtemo soil is 3a.

67C—Marlette-Oshtemo complex, 6 to 12 percent slopes. These gently rolling, well drained soils are on side slopes, knolls, and ridges. Individual areas are irregular in shape and range from 5 to 220 acres in size. They are about 45 to 50 percent Marlette soil and 40 to 45 percent Oshtemo soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Marlette soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil contains more clay. In other areas the substratum is sandy below a depth of 40 inches.

Typically, the Oshtemo soil has a surface layer of dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, very friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of about 80 inches is yellowish brown gravelly sand. In some areas sand and gravel are within a depth of 40 inches. In other areas the subsoil contains more clay.

Included with these soils in mapping are small areas of the sandy, excessively drained Coloma soils and the sandy, well drained Spinks soils. Both of these included soils are in landscape positions similar to those of the Marlette and Oshtemo soils. They make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Marlette soil. It is moderately rapid in the upper part of the Oshtemo soil and very rapid in the underlying gravelly sand. The available water capacity is high in the Marlette soil and moderate in the Oshtemo soil. Surface runoff is rapid on the Marlette soil and slow on the Oshtemo soil.

Most areas are used as cropland. Some areas are used as pasture or woodland.

These soils are fairly well suited to such crops as corn and soybeans. The major management concerns are water erosion, soil blowing, and tilth. Cropping systems that include close-growing crops, such as hay and small grain, can help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion and soil blowing. Buffer strips and field windbreaks help to control soil blowing. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

These soils are well suited to pasture. Grazing when the soils are excessively wet can cause compaction, damage the plant cover, and increase the susceptibility to water erosion and soil blowing. Proper stocking rates, pasture rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If these soils are used as woodland, there are no major management concerns.

Because of the slope, these soils are 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. The caving of cutbanks is a limitation in shallow excavations in areas of the Oshtemo soil. Reinforcing the trench walls helps to overcome this limitation.

The slope of both soils and the moderately slow permeability of the Marlette soil are limitations on sites for septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. Pressurized distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. Enlarging the absorption field helps to overcome the restricted permeability of the Marlette soil.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Marlette soil is 3A, and that assigned to the Oshtemo soil is 4A. The Michigan soil management group assigned to the Marlette soil is 2.5a, and that assigned to the Oshtemo soil is 3a.

67D—Marlette-Oshtemo complex, 12 to 18 percent slopes. These rolling, well drained soils are on side slopes, knolls, and ridges. Escarpments are common around lakes and swamps and along rivers. Individual areas are irregular in shape and range from 5 to 100 acres in size. They are about 45 to 50 percent Marlette soil and 40 to 45 percent Oshtemo soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Marlette soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil contains more clay. In other areas the substratum is sandy below a depth of 40 inches.

Typically, the Oshtemo soil has a surface layer of dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of about 80 inches is yellowish brown gravelly sand. In some areas sand and gravel are within a depth of 40 inches. In other areas the subsoil contains more clay.

Included with these soils in mapping are small areas of the sandy, excessively drained Coloma soils and the sandy, well drained Spinks soils on side slopes and toe slopes. These included soils make up about 5 to 15 percent of the unit.

Permeability is moderately slow in the Marlette soil. It is moderately rapid in the upper part of the Oshtemo soil and very rapid in the underlying gravelly sand. The available water capacity is high in the Marlette soil and moderate in the Oshtemo soil. Surface runoff is rapid on the Marlette soil and medium on the Oshtemo soil.

Most areas are used as woodland or hayland. Some areas are used as pasture or are idle.

These soils are poorly suited to such crops as corn and soybeans. The major management concerns are water erosion, soil blowing, and tilth. Cropping systems that include close-growing crops, such as hay and small grain, help to control water erosion and soil blowing. A system of conservation tillage that does not invert the soil and that leaves crop residue on the surface also helps to control water erosion and soil blowing. Buffer strips and field windbreaks help to control soil blowing. Minimizing tillage, tilling at the proper moisture content, returning crop residue to the soil, and growing green manure crops improve tilth.

These soils are fairly well suited to pasture. Grazing when the soils are excessively wet can cause compaction, damage the plant cover, and increase the susceptibility to water erosion and soil blowing. Proper stocking rates, pasture rotation or strip grazing, and restricted use during wet periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, provides a long-lived stand that has a long grazing season.

If these soils are used as woodland, there are no major management concerns.

Because of the slope, these soils are poorly 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 most areas. The caving of cutbanks is a limitation in shallow excavations in areas of the Oshtemo soil. Reinforcing the trench walls helps to overcome this limitation.

The slope of both soils and the moderately slow permeability of the Marlette soil are limitations on sites for septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Pressurized distribution systems that are installed across the slope can achieve uniform discharge rates from laterals at different elevations and help to overcome the slope. Enlarging the absorption field helps to overcome the restricted permeability of the Marlette soil.

The land capability classification is IVe. The woodland ordination symbol assigned to the Marlette soil is 3A, and that assigned to the Oshtemo soil is 4A. The Michigan soil management group assigned to the Marlette soil is 2.5a, and that assigned to the Oshtemo soil is 3a.

67E—Marlette-Oshtemo complex, 18 to 40 percent slopes. These hilly and steep, well drained soils are on side slopes, high knolls, and ridges. Slopes of more than 40 percent are common around lakes and swamps and along rivers. Individual areas are irregular in shape and range from 5 to 300 acres in size. They are about 45 to 50 percent Marlette soil and 40 to 45 percent Oshtemo soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Marlette soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas it is sandy below a depth of 40 inches. In other areas the subsoil contains more clay.

Typically, the Oshtemo soil has a surface layer of dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. In sequence downward, it is dark brown, firm sandy clay loam; dark brown, friable sandy loam; dark brown, very friable loamy sand; and strong brown and yellowish brown sand that has bands of strong brown loamy sand. The substratum to a depth of about 80 inches is yellowish brown gravelly sand. In some areas sand and gravel are within a depth of 40 inches. In other areas the subsoil contains more clay.

Included with these soils in mapping are small areas of the sandy, excessively drained Coloma soils and the sandy, well drained Spinks soils on side slopes and toe slopes. These included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Marlette soil. It is moderately rapid in the upper part of the Oshtemo soil and very rapid in the underlying gravelly sand. The available water capacity is high in the Marlette soil and moderate in the Oshtemo soil. Surface runoff is very rapid on the Marlette soil and medium on the Oshtemo soil.

Most areas are used as woodland or are idle. Some areas are used as hayland or pasture. Because of the slope and the hazard of water erosion, these soils are generally unsuitable as cropland and pasture.

If these soils are used as woodland, the erosion hazard and the equipment limitation are management concerns. Because of the erosion hazard, skid roads and logging roads should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging roads, and skid roads after the trees are logged helps to establish a protective cover. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and landings and in operating equipment. The roads should be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. When the soil is wet, unsurfaced roads are slippery and ruts form easily. Year-round logging roads should be graveled.

Because of the slope, these soils are generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Marlette soil is 3R, and that assigned to the Oshtemo soil is 4R. The Michigan soil management group assigned to the Marlette soil is 2.5a, and that assigned to the Oshtemo soil is 3a.

68B—Coloma-Marlette complex, 0 to 6 percent slopes. These nearly level to undulating, excessively drained and well drained soils are on low knolls and ridges. Individual areas are irregular in shape and range from 5 to 40 acres in size. They are about 60 to 65 percent Coloma soil and 25 to 30 percent Marlette soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Typically, the Marlette soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil contains more clay. In other areas it contains less clay.

Included with these soils in mapping are small areas of Boyer soils. These included soils are in landscape positions similar to those of the Coloma and Marlette soils. They have more clay in the subsoil than the Coloma soil and less clay in the subsoil than the Marlette soil and are underlain by calcareous sand and gravel within a depth of 40 inches. They make up about 5 to 15 percent of the unit.

Permeability is rapid in the Coloma soil and moderately slow in the Marlette soil. The available water capacity is low in the Coloma soil and high in the Marlette soil. Surface runoff is very slow on the Coloma soil and medium on the Marlette soil.

Most areas are used as cropland or are idle. Some areas are used as woodland or pasture.

These soils are poorly suited to such crops as corn and soybeans. The major management concerns are droughtiness, soil blowing, and water erosion. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control soil blowing and water erosion and conserve moisture. Fall-seeded crops, such as winter wheat and rye, and small grain seeded in early spring can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing.

These soils are fairly well suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soils are excessively dry can damage the plant cover and increase the susceptibility to soil blowing and water erosion. Proper stocking rates, rotation or strip grazing, and restricted use during wet or dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If these soils are used as woodland, there are no major management concerns.

These soils generally are well suited to building site development. The caving of cutbanks is a limitation in shallow excavations in areas of the Coloma soil. Reinforcing the trench walls helps to overcome this limitation. The Coloma soil is only fairly well 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 Marlette soil is poorly suited to septic tank absorption fields because of the moderately slow permeability. Pressurized distribution systems can achieve uniform discharge rates from all points in the absorption field and help to overcome the poor filtering capacity of the Coloma soil. Enlarging the absorption field helps to overcome the restricted permeability of the Marlette soil.

The land capability classification is IVs. The woodland ordination symbol assigned to the Coloma soil is 2A, and that assigned to the Marlette soil is 3A. The Michigan soil management group assigned to the Coloma soil is 4a, and that assigned to the Marlette soil is 2.5a.

68C—Coloma-Marlette complex, 6 to 12 percent slopes. These gently rolling, excessively drained and well drained soils are on side slopes, knolls, and ridges. Individual areas are irregular in shape and range from 5 to 160 acres in size. They are about 60 to 65 percent Coloma soil and 25 to 30 percent Marlette soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Typically, the Marlette soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil contains more clay. In other areas it contains less clay.

Included with these soils in mapping are small areas of Boyer soils. These included soils are in landscape positions similar to those of the Coloma and Marlette soils. They have more clay in the subsoil than the Coloma soil and less clay in the subsoil than the Marlette soil and are underlain by calcareous sand and gravel within a depth of 40 inches. They make up about 5 to 15 percent of the unit.

Permeability is rapid in the Coloma soil and moderately slow in the Marlette soil. The available water capacity is low in the Coloma soil and high in the Marlette soil. Surface runoff is slow on the Coloma soil and medium on the Marlette soil.

Most areas are used as cropland or are idle. Some areas are used as woodland or pasture.

Because of droughtiness, the hazard of soil blowing, and the slope, these soils are generally unsuitable as cropland. If good management is applied, however, such crops as corn and soybeans can be grown. Growing green manure crops and regularly adding other organic material to the soil increase the available water capacity. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface conserve moisture and help to control soil blowing. Fall-seeded crops, such as winter wheat and rye, and small grain seeded in early spring can make good use of the limited supply of available moisture. Establishing field windbreaks or buffer strips, applying a system of rough tillage, and ridging at an angle to the prevailing wind help to control soil blowing.

These soils are poorly suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soils are excessively dry can damage the plant cover and increase the susceptibility to soil blowing and water erosion. Proper stocking rates, rotation or strip grazing, and restricted use during wet or dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If these soils are used as woodland, there are no major management concerns.

These soils are fairly well suited to building site development. The slope is the main limitation. Buildings should be designed so that they conform to the natural slope of the land. The caving of cutbanks is a limitation in shallow excavations in areas of the Coloma soil. Reinforcing the trench walls helps to overcome this limitation.

The slope of both soils, a poor filtering capacity in the Coloma soil, and the moderately slow permeability of the Marlette soil are limitations on sites for septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly. Pressurized distribution systems that are installed across the slope can achieve uniform discharge rates from all points in the absorption field and help to overcome the poor filtering capacity of the Coloma soil. Enlarging the absorption field helps to overcome the restricted permeability of the Marlette soil.

The land capability classification is VIs. The woodland ordination symbol assigned to the Coloma soil is 2A, and that assigned to the Marlette soil is 3A. The Michigan soil management group assigned to the Coloma soil is 4a, and that assigned to the Marlette soil is 2.5a.

68D—Coloma-Marlette complex, 12 to 18 percent slopes. These rolling, excessively drained and well drained soils are on side slopes, knolls, and ridges. Escarpments are common around lakes and swamps and along rivers. Individual areas are irregular in shape and range from 5 to 80 acres in size. They are about 60 to 65 percent Coloma soil and 25 to 30 percent Marlette soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 16 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas, the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Typically, the Marlette soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil contains more clay. In other areas it contains less clay.

Included with these soils in mapping are small areas of Boyer soils. These included soils are in landscape positions similar to those of the Coloma and Marlette soils. They have more clay in the subsoil than the Coloma soil and less clay in the subsoil than the Marlette soil and are underlain by calcareous sand and gravel within a depth of 40 inches. They make up about 5 to 15 percent of the unit.

Permeability is rapid in the Coloma soil and moderately slow in the Marlette soil. The available water capacity is low in the Coloma soil and high in the Marlette soil. Surface runoff is medium on the Coloma soil and rapid on the Marlette soil.

Most areas are used as woodland or are idle. Some areas are used as hayland or pasture. Because of droughtiness, the hazard of soil blowing, and the slope, these soils are generally unsuitable as cropland. They are poorly suited to pasture. The major management concerns are droughtiness and overgrazing. Overgrazing or grazing when the soils are excessively dry can damage the plant cover and can greatly increase the susceptibility to soil blowing and water erosion. Proper stocking rates, rotation or strip grazing, and restricted use during wet or dry periods help to keep the pasture in good condition and help to control water erosion and soil blowing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, provides a long-lived stand that has a long grazing season.

If these soils are used as woodland, there are no major management concerns.

Because of the slope, these soils are poorly 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 most areas. The caving of cutbanks is a limitation in shallow excavations in areas of the Coloma soil. Reinforcing the trench walls helps to overcome this limitation.

Because of the slope of both soils, a poor filtering capacity in the Coloma soil, and the moderately slow permeability of the Marlette soil, these soils are 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. Pressurized distribution systems that are installed across the slope can achieve uniform discharge rates from all points in the absorption field and help to overcome the poor filtering capacity of the Coloma soil. Enlarging the absorption field helps to overcome the restricted permeability of the Marlette soil.

The land capability classification is VIs. The woodland ordination symbol assigned to the Coloma soil is 2A, and that assigned to the Marlette soil is 3A. The Michigan soil management group assigned to the Coloma soil is 4a, and that assigned to the Marlette soil is 2.5a.

68E—Coloma-Marlette complex, 18 to 40 percent slopes. These hilly and steep, excessively drained and well drained soils are on side slopes, high knolls, and ridges. Individual areas are irregular in shape and range from 5 to 80 acres in size. They are about 60 to 65 percent Coloma soil and 25 to 30 percent Marlette soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, very friable and loose sand about 15 inches thick. Below this to a depth of 60 inches are alternating bands of yellowish brown, loose sand and dark brown, very friable loamy sand. In some areas stratified sand and gravel are below a depth of 60 inches. In other areas the bands of loamy sand have a total thickness of more than 6 inches. In places the soil has no bands.

Typically, the Marlette soil has a surface layer of very dark grayish brown loam about 9 inches thick. The next 16 inches is pale brown, friable fine sandy loam mixed with dark yellowish brown loam. The subsoil is dark yellowish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is yellowish brown loam. In some areas the subsoil contains more clay. In other areas it contains less clay.

Included with these soils in mapping are small areas of Boyer soils. These included soils are in landscape positions similar to those of the Coloma and Marlette soils. They have more clay in the subsoil than the Coloma soil and less clay in the subsoil than the Marlette soil and are underlain by calcareous sand and gravel within a depth of 40 inches. Also included, around lakes and swamps and along streams, are areas of Coloma and Marlette soils that have slopes of more than 40 percent. Included soils make up about 5 to 15 percent of the unit.

Permeability is rapid in the Coloma soil and moderately slow in the Marlette soil. The available water capacity is low in the Coloma soil and high in the Marlette soil. Surface runoff is medium in the Coloma soil and very rapid in the Marlette soil.

Most areas are used as woodland or are idle. Some areas are used as pasture. Because of the slope and the hazard of water erosion, these soils are generally unsuitable as cropland and pasture.

If these soils are used as woodland, the erosion hazard, the equipment limitation, and the seedling mortality rate are management concerns. Because of the erosion hazard, skid roads and logging roads should be established on the contour and water should be removed by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Seeding landings, logging roads, logging areas, and skid roads after the trees are logged helps to establish a protective cover. The use of equipment is restricted by the slope. Special care is needed in laying out logging roads and landings and in operating equipment. The roads should be designed so that they conform to the natural slope of the land. The grade should be kept as low as possible. Droughtiness in the surface layer of the Coloma soil reduces the seedling survival rate. Planting containerized seedlings or other special nursery stock can reduce the seedling mortality rate. Harvest methods that leave some mature trees to provide shade and protection for the seedlings may be desirable.

Because of the slope, these soils are generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Coloma soil is 2R, and that assigned to the Marlette soil is 3R. The Michigan soil management group assigned to the Coloma soil is 4a, and that assigned to the Marlette soil is 2.5a.

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 expenditure 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.

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 wetter, 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 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. 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."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has 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 bedrock, 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

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 and hay and pasture plants 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.

In 1986, about 52,000 acres in the county was planted to corn, of which about 5,700 acres was harvested for silage. About 13,300 acres was planted to wheat, 11,000 acres to soybeans, and 5,600 acres to oats. The other common crops in the county are hay, dry beans, barley, and potatoes *(8)*.

The main management needs on the cropland and pasture are measures that control water erosion and soil blowing, reduce the wetness of some soils, conserve moisture, and maintain or improve fertility and tilth.

Water erosion is a major hazard on about two-thirds of the cropland in Barry County *(16)*. It is a hazard where slopes are more than 2 percent. Loss of the surface layer through erosion reduces the productivity of soils and results in sedimentation in streams and open ditches. Erosion-control practices provide a protective cover, help to control runoff, and increase the rate of water infiltration. A cropping system that keeps a vegetative cover on the soil for extended periods helps to control erosion and preserves the productive capacity of the soils. Including forage crops of grasses and legumes in the cropping system helps to control erosion on sloping land, provides nitrogen for other crops, and improves tilth. Conservation tillage helps to control runoff and erosion. The main systems of conservation tillage in Barry County are chisel-disc, no-till, ridge-till, and disc-plant. Cover crops, crop residue management, and grassed waterways also help to control erosion. Contour farming is generally not feasible because of short, complex slopes.

Soil blowing is a hazard on the sandy Coloma, Boyer, and Spinks soils and in drained areas of the mucky Adrian, Edwards, Houghton, and Palms soils. Some of the loamy soils also are susceptible to soil blowing. Maintaining a vegetative cover, using surface mulch, planting buffer strips, and roughing the surface through proper tillage methods help to control soil blowing. Vegetative barriers and windbreaks also help to control soil blowing.

Soil drainage is a major management concern on about 10 percent of the cropland in the county. Draining cropland improves the air-water relationship in the root zone. Spring planting, spraying, and harvesting are delayed and weed control is more difficult where drainage is poor. Properly designed tile drains, surface drains, or both, can remove excess water.

Some soils are naturally so wet that the production of crops commonly grown in the county generally is not possible. Unless artificially drained, very poorly drained, poorly drained, and somewhat poorly drained soils are so wet that crops are damaged in most years. Examples are Brady, Capac, Colwood, Granby, Ithaca, Kibbie, Lenawee, Matherton, Parkhill, Sebewa, Selfridge, and Thetford soils. The soils in the county that are generally undrained are in land capability subclass Vw or VIw. The wet soils that generally are artificially drained are in capability subclass IIe, IIw, or IIIw.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface and tile drains is needed in most areas of poorly drained and very poorly drained soils that are intensively row cropped. The drains should be more closely spaced in moderately slowly permeable or slowly permeable soils, such as Capac, Ithaca, Lenawee, and Parkhill soils, than in the more permeable soils. Finding adequate outlets for tile drainage systems is difficult in many areas of Adrian, Colwood, Edwards, Glendora, Granby, Houghton, Lenawee, Palms, Sebewa, and Sloan soils. Diversions can be used in some areas to divert runoff from wet areas. Good tilth and an ample supply of organic matter also improve drainage.

Organic soils oxidize and subside when their pore space is filled with air; therefore, special drainage systems are needed to control the depth and period of drainage in such soils. Maintaining the water table at the level required by 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. Further information about the design of drainage systems for each kind of soil is available in local offices of the Soil Conservation Service.

Droughtiness is a limitation on Boyer, Coloma, Oshtemo, and Spinks soils. These soils can be cropped effectively if they are irrigated by sprinklers. Irrigated areas can be used for specialty crops, such as strawberries. Irrigation is feasible in areas where manmade ponds, surface water, and large-diameter wells are suitable sources of water and where the soils have a good intake rate. Conservation tillage, grassed waterways, and good management of irrigation water are needed to control runoff and erosion and improve the efficiency of the irrigation system.

Soil fertility is naturally medium in loamy soils and low in most sandy soils. Many sandy soils are naturally medium acid or slightly acid. Applications of lime or marl are needed to raise the pH level sufficiently for good growth of alfalfa and other crops that grow well only on nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields *(9)*. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous.

Some of the soils used for crops have a sandy surface layer that is light in color and low in organic matter content. Generally, the structure of such soils is weak. A surface crust forms during periods of heavy rainfall. This crusting decreases the rate of water infiltration and increases the runoff rate. Regular additions of crop residue, manure, and other organic material improve tilth and help to prevent surface crusting.

Maintaining tilth in the loamy Capac, Colwood, Marlette, Matherton, Parkhill, Sebewa, Ithaca, Perrinton, and Lenawee soils is difficult. These soils stay wet until late in spring. If plowed when wet, they tend to be compacted and very cloddy when dry. As a result, preparing a good seedbed is difficult. Cover crops, green manure crops, crop residue management, conservation tillage, and applications of livestock manure help to maintain or improve the organic matter content and tilth.

Grazing during wet periods results in compaction, which retards the growth of pasture plants. Proper pasturing methods improve the plant cover and help to prevent compaction.

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 key forage species, rotation grazing, deferred grazing, and strategically located water supplies for livestock. The key forage species include alfalfa and smooth bromegrass on medium textured, well drained soils; birdsfoot trefoil, bromegrass, and orchardgrass on wet or hilly, erodible soils; and reed canarygrass on undrained mucks.

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 6. 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 6 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 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 hazard is the 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, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. 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 *(10)*. The soils are assigned to a group according to the dominant profile texture, the natural drainage class, and the major management concerns.

Woodland Management and Productivity

Table 8 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; *F*, a high content of rock fragments in the soil; and *L*, low strength. 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, F, and L.

In table 8, *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 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 in a fully stocked, even-aged, unmanaged stand. The volume was determined through the use of standard yield tables *(15)*.

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 9 shows the height that locally grown trees and shrubs are predicted to reach in 20 years on various soils. The estimates in table 9 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 10 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 sewer lines. 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 10, 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 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

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 gentle 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 bedrock or a hardpan 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.

Wildlife Habitat

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 11, 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 corn, wheat, oats, rye, and barley.

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, reed canarygrass, bromegrass, clover, alfalfa, redtop, and orchardgrass.

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 lambsquarters, goldenrod, nightshade, ragweed, dandelion, wild carrot, and thistle.

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, maple, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are American cranberrybush, autumn olive, crabapple, honeysuckle, dogwood, and silver buffaloberry.

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 and spruce.

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, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cattail, bulrush, sedges, reeds, and arrowhead.

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 wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

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. Wildlife attracted to these areas include bobwhite quail, ring-necked pheasant, meadowlark, field sparrow, cottontail, red fox, woodchuck, and hawks.

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 opossum, woodcock, thrushes, woodpeckers, tree squirrels, gray fox, raccoon, deer, and southern flying squirrel.

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, mink, 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 underground 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 12 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, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 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 13 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 13 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 is 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 13 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 13 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 14 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, a 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 a 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. These soils 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 14, 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 toxic material and 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 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and 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, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to permeable material. Excessive slope can affect the storage capacity of the reservoir area.

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 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. 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.

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 classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 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. 11). "Loam," for example, is soil that is

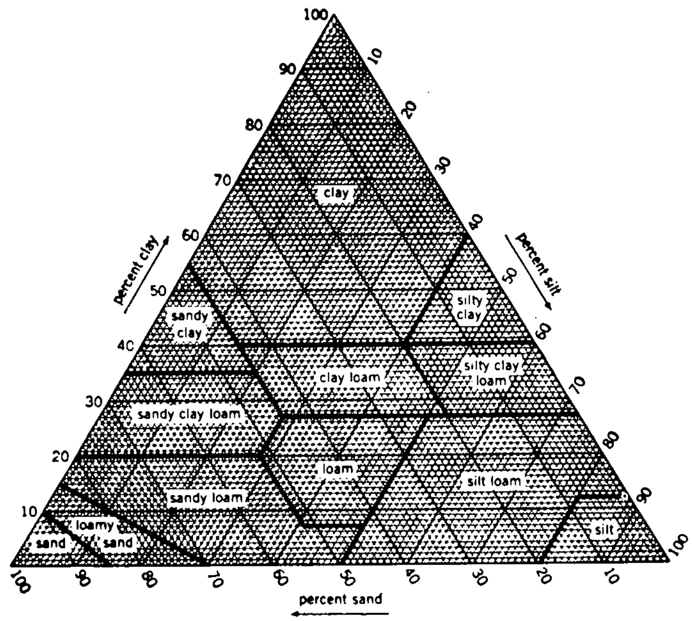

Figure 11.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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 17 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 ⅓ 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. Coarse sands, 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 coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, 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 loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous 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. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, 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 in 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 18 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 infiltration 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 18, 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 18 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.

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 18 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 18.

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 18 shows the expected initial subsidence, which usually is a result of drainage, and 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

Several of the soils in Barry County were sampled for physical and chemical analyses by the Soil Research Laboratory, Michigan Technological University, Houghton, Michigan. The laboratory data obtained from the soil samples included 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.

These data were used in classifying and correlating the soils and in evaluating their behavior. A total of three profiles were selected as representatives of their respective series. These series and their laboratory identification numbers are as follows: Okee (S86MI-015-001), combined with Spinks soils during correlation, and Tekenink (S86MI-015-002 and S86MI-015-003).

In addition to the Barry County data, soil characterization data and forest site data are available from nearby counties having many of the same soils that are in Barry County. These data and the Barry County data are available at the Soil Research Laboratory, Michigan Technological University, Houghton, Michigan; the Soil and Water Conservation Divisi6n, 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 19 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 Alfisol.

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 Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

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 Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that has a udic 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 Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, 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 Hapludalfs.

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. 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 swamps, along waterways, and in depressions on till plains, moraines, and outwash plains. These soils formed in deposits of organic material 16 to 50 inches deep over sandy material. Permeability is moderately slow to moderately rapid in the upper part of the pedon and rapid in the lower part. Slope is 0 to 1 percent.

Typical pedon of Adrian muck, 1,710 feet north and 2,500 feet east of the southwest corner of sec. 7, T. 2 N., R. 10 W.

Oa1—0 to 10 inches; muck, black (N 2/0) broken face and rubbed; about 10 percent fiber, less than 5 percent rubbed; moderate fine granular structure; friable; medium acid; abrupt wavy boundary.

Oa2—10 to 17 inches; muck, dark reddish brown (5YR 2/2) broken face, black (5YR 2/1) rubbed; about 10 percent fiber, 0 percent rubbed; moderate medium subangular blocky structure; friable; strongly acid; abrupt smooth boundary.

Oa3—17 to 24 inches; muck, dark reddish brown (5YR 2/2) broken face and rubbed; about 5 percent fiber, 0 percent rubbed; moderate thick platy structure; friable; about 10 percent sand; strongly acid; abrupt wavy boundary.

C—24 to 37 inches; pale brown (10YR 6/3) sand; common medium prominent strong brown (7.5YR 4/6) mottles; single grain; loose; strongly acid; clear wavy boundary.

Cg1—37 to 53 inches; gray (5Y 5/1) sand; single grain; loose; neutral; abrupt wavy boundary.

Cg2—53 to 60 inches; gray (5Y 5/1), stratified coarse sand and gravelly sand; single grain; loose; about 15 percent gravel; strong effervescence; moderately alkaline.

Depth to the sandy C horizon ranges from 16 to 50 inches. The fiber is primarily herbaceous, but in some pedons as much as 50 percent of the volume is woody material.

The surface tier has hue of 10YR or is neutral in hue. It has chroma of 0 to 3. The subsurface and bottom tiers have hue of 5YR or 10YR or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 3. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 6, and chroma of 1 to 3. It is coarse sand, gravelly sand, fine sand, loamy sand, sand, or sand that has strata of gravel.

Algansee Series

The Algansee series consists of somewhat poorly drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvial material. Slope is 0 to 1 percent.

The Algansee soils in this county are taxadjuncts to the series because they have a thicker surface layer than is definitive for the series. This difference, however, does not alter the use and management of the soils.

Typical pedon of Algansee loamy fine sand, 1,056 feet north and 1,188 feet west of the southeast corner of sec. 15, T. 4 N., R. 10 W.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; moderate medium granular structure; very friable; neutral; abrupt smooth boundary.

C1—12 to 21 inches; yellowish brown (10YR 5/4) fine sand; few fine distinct yellowish brown (10YR 5/8) mottles; single grain; loose; mildly alkaline; abrupt wavy boundary.

C2—21 to 28 inches; dark brown (10YR 4/3) loamy fine sand; few fine faint grayish brown (10YR 5/2) mottles; massive; very friable; mildly alkaline; abrupt wavy boundary.

C3—28 to 32 inches; light yellowish brown (10YR 6/4) sand; common fine distinct light brownish gray (10YR 6/2) mottles; single grain; loose; about 12 percent shell fragments; strong effervescence; moderately alkaline; abrupt wavy boundary.

C4—32 to 41 inches; yellowish brown (10YR 5/4) fine sand; light gray (10YR 7/2) washed sand grains; dark brown (10YR 4/3) organic bands; single grain; loose; strong effervescence; moderately alkaline; abrupt wavy boundary.

C5—41 to 50 inches; light yellowish brown (10YR 6/4) sand; common fine prominent strong brown (7.5YR 5/6 and 5/8), common medium distinct grayish brown (10YR 5/2), and common fine distinct light brownish gray (10YR 6/2) mottles; dark brown (10YR 4/3) organic stains; single grain; loose; about 2 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C6—50 to 60 inches; light yellowish brown (10YR 6/4), stratified loamy fine sand and loamy very fine sand; common fine prominent strong brown (7.5YR 5/8) and yellowish red (5YR 4/6), common medium distinct dark grayish brown (10YR 4/2), and common fine distinct grayish brown (10YR 5/2) mottles; massive; very friable; strong effervescence; moderately alkaline.

The Ap horizon has value of 2 to 4 and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes sand, loamy sand, fine sandy loam, and sandy loam. The C horizon has value of 3 to 6 and chroma of

Figure 12.—Profile of Boyer loamy sand. The boundary between the upper and lower parts of the subsoil is irregular in some areas.

2 to 4. It is dominantly sand, fine sand, loamy fine sand, or loamy sand stratified with loamy very fine sand. In some pedons, however, it has thin strata of gravel, loam, or sandy loam.

Boyer Series

The Boyer series consists of well drained soils on outwash plains, river terraces, kames, and moraines. These soils formed in sandy and loamy material underlain by sand and gravel (fig. 12). Permeability is moderately rapid in the upper part of the pedon and very rapid in the lower part. Slope ranges from 0 to 40 percent.

Typical pedon of Boyer loamy sand, 0 to 6 percent slopes, 2,508 feet north and 1,491 feet west of the southeast corner of sec. 27, T. 3 N., R. 8 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; moderate medium granular structure; very friable; about 2 percent gravel; medium acid; abrupt smooth boundary.

Bw—9 to 19 inches; dark yellowish brown (10YR 4/6) loamy sand; weak fine subangular blocky structure; very friable; about 2 percent gravel; slightly acid; clear wavy boundary.

Bt1—19 to 28 inches; strong brown (7.5YR 4/6) gravelly sandy loam; moderate medium subangular blocky structure; friable; common distinct dark brown (7.5YR 3/4) clay films on faces of peds; about 15 percent gravel and cobbles; neutral; clear wavy boundary.

Bt2—28 to 33 inches; dark brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure; firm; many distinct dark brown (7.5YR 3/2) clay films on faces of peds; about 20 percent gravel and cobbles; neutral; abrupt wavy boundary.

2C—33 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; about 20 percent gravel and cobbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. It coincides with the depth to free carbonates. The content of pebbles and cobbles ranges from 5 to 25 percent in the solum and from 10 to 55 percent in the 2C horizon.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly loamy sand, but the range includes gravelly loamy sand, loamy fine sand, and sandy loam. The Bw horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is loamy sand, gravelly loamy sand, or sandy loam. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 3 to 6. It is gravelly sandy loam, gravelly sandy clay loam, sandy loam, or sandy clay loam. The 2C horizon has value of 5 or 6 and chroma of 2 to 4. It is stratified sand and gravel, gravelly sand, or sand.

Brady Series

The Brady series consists of somewhat poorly drained soils on outwash plains, valley trains, terraces, and lake plains. These soils formed in loamy material underlain by sand and gravel. 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.

Typical pedon of Brady sandy loam, 0 to 3 percent slopes, 430 feet south and 2,530 feet east of the northwest corner of sec. 29, T. 4 N., R. 10 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; moderate fine granular structure; friable; about 2 percent gravel; strongly acid; abrupt smooth boundary.

Bt1—9 to 17 inches; dark yellowish brown (10YR 4/4) sandy loam; common medium distinct grayish brown (10YR 5/2) and many medium prominent strong brown (7.5YR 4/6 and 5/8) mottles; moderate medium subangular blocky structure; friable; common faint grayish brown (10YR 5/2) clay films on faces of peds; about 2 percent gravel; strongly acid; clear wavy boundary.

Bt2—17 to 25 inches; yellowish brown (10YR 5/4) sandy loam; common fine distinct light brownish gray (10YR 6/2) and many coarse prominent strong brown (7.5YR 5/6 and 5/8) mottles; moderate fine subangular blocky structure; friable; common clay bridges; about 2 percent gravel; strongly acid; clear wavy boundary.

BC—25 to 41 inches; yellowish brown (10YR 5/4) loamy sand; many coarse distinct grayish brown (10YR 5/2) and common coarse prominent strong brown (7.5YR 5/6 and 5/8) mottles; weak fine subangular blocky structure parting to single grain; very friable; about 2 percent gravel; medium acid; clear wavy boundary.

2C1—41 to 50 inches; pale brown (10YR 6/3) coarse sand; common medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; single grain; loose; about 5 percent gravel; neutral; clear wavy boundary.

2C2—50 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; about 15 percent gravel and cobbles; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. The content of pebbles and cobbles ranges from 0 to 20 percent in the solum.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 to 3. It is dominantly sandy loam, but the range includes fine sandy loam and loamy sand. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sandy loam, gravelly sandy loam, sandy clay loam, or gravelly sandy clay loam. The 2C horizon has value of 4 to 6 and chroma of 1 to 4. It is gravelly coarse sand, gravelly sand, coarse sand, sand, or stratified sand and gravel.

Brems Series

The Brems series consists of moderately well drained, rapidly permeable soils on outwash plains. These soils formed in sandy material. Slope ranges from 0 to 3 percent.

Typical pedon of Brems sand, 0 to 3 percent slopes, 2,540 feet north and 1,125 feet west of the southeast corner of sec. 18, T. 2 N., R. 10 W.

A1—0 to 1 inch; black (10YR 2/1) sand, very dark gray (10YR 3/1) dry; moderate very fine granular structure; very friable; medium acid; abrupt wavy boundary.

A2—1 to 7 inches; dark brown (10YR 3/3) sand, pale brown (10YR 6/3) dry; weak fine granular structure parting to single grain; loose; about 2 percent gravel; medium acid; abrupt wavy boundary.

Bw1—7 to 22 inches; strong brown (7.5YR 5/8) sand; weak fine subangular blocky structure parting to single grain; loose; about 2 percent gravel; medium acid; gradual wavy boundary.

Bw2—22 to 29 inches; strong brown (7.5YR 5/6) sand; common medium prominent yellowish red (5YR 5/8) and common medium faint strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure parting to single grain; very friable; about 5 percent gravel; medium acid; gradual wavy boundary.

Bw3—29 to 39 inches; strong brown (7.5YR 5/8) sand; common coarse and few medium distinct yellowish red (5YR 5/8 and 4/6) mottles; weak fine subangular blocky structure parting to single grain; very friable; about 10 percent gravel; slightly acid; clear wavy boundary.

C1—39 to 54 inches; brownish yellow (10YR 6/6) sand; few coarse distinct light gray (10YR 7/2) and common fine distinct brownish yellow (10YR 6/8) mottles; single grain; loose; about 10 percent gravel; slightly acid; clear wavy boundary.

C2—54 to 60 inches; light yellowish brown (10YR 6/4) sand; common fine distinct brownish yellow (10YR 6/8) mottles; single grain; loose; about 10 percent gravel; medium acid.

The thickness of the solum ranges from 35 to 70 inches. The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has value of 2 to 4 and chroma of 1 to 4. It is dominantly sand, but the range includes loamy sand, loamy fine sand, and fine sand. The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 8. It is loamy sand, sand, loamy fine sand, or fine sand. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 to 6. It is sand, fine sand, or loamy fine sand.

Capac Series

The Capac series consists of somewhat poorly drained, moderately slowly permeable soils on till plains and moraines. These soils formed in loamy material. Slope ranges from 0 to 4 percent.

The Capac soils in this county are taxadjuncts to the series because they do not have a dominant chroma of 2 or less in the upper part of the argillic horizon. This difference, however, does not alter the use and management of the soils.

Typical pedon of Capac fine sandy loam, 0 to 4 percent slopes, 115 feet south and 1,550 feet east of the northwest corner of sec. 28, T. 4 N., R. 7 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak very thick platy structure parting to moderate very fine subangular blocky; friable; about 2 percent gravel; neutral; abrupt smooth boundary.

B/E—8 to 15 inches; dark yellowish brown (10YR 4/4) clay loam (B); brown (10YR 5/3) coatings of sandy loam on faces of peds (E); common fine distinct grayish brown (10YR 5/2) and many coarse distinct yellowish brown (10YR 5/6 and 5/8) mottles; common distinct dark brown (10YR 4/3) coatings on faces of peds; moderate medium subangular blocky structure; firm; about 2 percent gravel; medium acid; clear wavy boundary.

Bt—15 to 20 inches; yellowish brown (10YR 5/4) clay loam; few medium distinct gray (10YR 5/1), common medium distinct grayish brown (10YR 5/2), and many medium distinct yellowish brown (10YR 5/8) mottles; weak very thick platy structure parting to moderate medium subangular blocky; firm; common prominent dark brown (10YR 4/3) clay films; about 2 percent gravel; neutral; clear wavy boundary.

BC—20 to 24 inches; yellowish brown (10YR 5/4) loam; common medium distinct gray (10YR 5/1), grayish brown (10YR 5/2), and yellowish brown (10YR 5/6 and 5/8) mottles; weak thick platy structure parting to moderate thin platy; friable; about 2 percent gravel; moderately alkaline; abrupt wavy boundary.

C—24 to 60 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) and common coarse distinct yellowish brown (10YR 5/8) mottles; strong very thick platy structure parting to moderate very fine subangular blocky; friable; about 2 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 24 to 40 inches. The content of gravel and cobbles ranges from 2 to 10 percent throughout the profile.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly fine sandy loam, but the range includes sandy loam, loam, and silt loam. The Bt horizon has value of 4 to 6 and chroma of 2 to 6. It is clay loam, loam, sandy clay loam, or silty clay loam. The C horizon has value of 5 or 6 and chroma of 2 to 6. It is loam or clay loam.

Coloma Series

The Coloma series consists of excessively drained, rapidly permeable soils on outwash plains, kames, and moraines. These soils formed in sandy material. Slope ranges from 0 to 40 percent.

Typical pedon of Coloma loamy sand, 0 to 6 percent slopes, 920 feet south and 745 feet east of the northwest corner of sec. 12, T. 3 N., R. 10 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; moderate fine granular structure; very friable; about 3 percent gravel; slightly acid; abrupt smooth boundary.

E1—9 to 16 inches; yellowish brown (10YR 5/4) sand; weak coarse subangular blocky structure; very friable; about 5 percent gravel; slightly acid; clear wavy boundary.

E2—16 to 25 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 10 percent gravel; medium acid; abrupt broken boundary.

E&Bt1—25 to 36 inches; yellowish brown (10YR 5/6) sand (E); single grain; loose; dark brown (7.5YR 4/4) lamellae of loamy sand (Bt) with a total thickness of about 1 inch; moderate very fine subangular blocky structure; very friable; clay bridges in the Bt part; about 10 percent gravel; medium acid; abrupt wavy boundary.

E&Bt2—36 to 60; yellowish brown (10YR 5/6) sand (E); single grain; loose; dark brown (7.5YR 4/4) lamellae of loamy sand (Bt) with a total thickness of about 2 inches; moderate very fine subangular blocky structure; very friable; clay bridges in the Bt part; about 1 percent gravel; medium acid.

The thickness of the solum ranges from 40 to more than 60 inches. The content of gravel and cobbles ranges from 0 to 10 percent in the solum and from 0 to 15 percent in the C horizon.

The A horizon has value of 2 or 3 and chroma of 1 to 3. It is dominantly loamy sand, but the range includes sand and loamy fine sand. The E horizon has value and chroma of 4 to 6. The Bt part of the E&Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It occurs as lamellae 1/16 inch to 2 inches thick. The total thickness of the lamellae is less than 6 inches. The C horizon, if it occurs, is sand.

Colwood Series

The Colwood series consists of poorly drained, moderately permeable soils in depressions on moraines, outwash plains, and lake plains. These soils formed in stratified, silty and loamy material. Slope ranges from 0 to 2 percent.

Typical pedon of Colwood loam, 1,850 feet south and 160 feet west of the northeast corner of sec. 6, T. 1 N., R. 9 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, gray (10YR 5/1) dry; common medium prominent yellowish red (5YR 4/6) and dark reddish brown (5YR 3/4) mottles; coarse medium granular structure; friable; mildly alkaline; abrupt smooth boundary.

Bg1—10 to 17 inches; gray (5Y 5/1) silty clay loam; common medium prominent olive brown (2.5Y 4/4) and common fine prominent strong brown (7.5YR 4/6) mottles; strong fine angular blocky structure; very firm; black (N 2/0) organic coatings on faces of peds; mildly alkaline; gradual wavy boundary.

Bg2—17 to 24 inches; light brownish gray (2.5Y 6/2) fine sandy loam; common medium prominent yellowish brown (10YR 5/6 and 5/8) and common medium distinct gray (5Y 5/1) mottles; moderate medium subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

Cg1—24 to 34 inches; light gray (5Y 6/1) loam that has thin strata of silt loam; common coarse faint gray (5Y 5/1) and common medium prominent strong brown (7.5YR 5/6) mottles; weak very thick platy structure parting to weak medium subangular blocky; friable; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg2—34 to 55 inches; light gray (5Y 6/1) loam that has thin strata of fine sandy loam and silt loam; many coarse prominent yellowish brown (10YR 5/6) and common fine prominent strong brown (7.5YR 5/6) mottles; weak very thick platy structure parting to weak medium subangular blocky; friable; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg3—55 to 60 inches; gray (5Y 5/1) silt loam; many coarse distinct greenish gray (5BG 5/1) mottles; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 50 inches. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam, very fine sandy loam, and fine sandy loam.

The B horizon has hue of 2.5Y, 5Y, or 10YR and value of 4 to 6. It is silty clay loam, loam, fine sandy loam, silt loam, or clay loam. The C 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, fine sandy loam, very fine sand, or fine sand and is commonly stratified.

Edwards Series

The Edwards series consists of very poorly drained soils in swamps, along waterways, and in depressions on till plains, moraines, and outwash plains. These soils formed in deposits of organic material 16 to 50 inches deep over marl. Permeability is moderately slow to moderately rapid in the upper part of the pedon and variable in the marl. Slope is 0 to 1 percent.

Typical pedon of Edwards muck, 2,575 feet north and 2,275 feet west of the southeast corner of sec. 3, T. 3 N., R. 10 W.

Oa1--0 to 20 inches; muck, black (N 2/0) broken face and rubbed; about 5 percent fiber, 2 percent rubbed; moderate medium granular structure; friable; mildly alkaline; clear smooth boundary.

Oa2—20 to 22 inches; muck, black (N 2/0) broken face and rubbed; about 3 percent fiber, 1 percent rubbed; massive; friable; mildly alkaline; abrupt smooth boundary.

Cg—22 to 60 inches; gray (10YR 6/1) marl; massive; friable; strong effervescence; moderately alkaline.

The depth to marl ranges from 16 to 50 inches. The fiber is primarily herbaceous, but in some pedons about 20 percent of the volume is woody material.

The surface tier has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. Layers of mucky peat less than 10 inches thick are in some pedons. The C horizon has hue of 10YR or 2.5Y, value of 5 to 8, and chroma of 1 or 2.

Elston Series

The Elston series consists of well drained, moderately rapidly permeable soils on outwash plains. These soils formed in loamy and sandy material. Slope ranges from 0 to 6 percent.

Typical pedon of Elston sandy loam, 0 to 6 percent slopes, 105 feet west and 2,640 feet south of the northeast corner of sec. 28, T. 4 N., R. 10 W.

Ap—0 to 8 inches; black (10YR 2/1) sandy loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure parting to moderate fine granular; friable; about 2 percent gravel; neutral; abrupt smooth boundary.

A1—8 to 13 inches; black (10YR 2/1) sandy loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; about 2 percent gravel; slightly acid; clear wavy boundary.

A2—13 to 18 inches; dark brown (10YR 3/3) and black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; friable; about 2 percent gravel; slightly acid; clear wavy boundary.

Bt1—18 to 28 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common prominent dark brown (7.5YR 3/4) clay films on faces of peds and around coarse fragments; about 2 percent gravel; slightly acid; clear wavy boundary.

Bt2—28 to 35 inches; dark yellowish brown (10YR 4/6) loamy sand; weak medium subangular blocky structure; very friable; common distinct dark brown (10YR 3/3) clay films on faces of peds and around coarse fragments; about 2 percent gravel; slightly acid; clear wavy boundary.

BC1—35 to 39 inches; yellowish brown (10YR 5/6) loamy sand; single grain; loose; about 2 percent gravel; medium acid; clear wavy boundary.

BC2—39 to 60 inches; dark yellowish brown (10YR 4/4) loamy sand; strong brown (7.5YR 4/6) sandy loam lamellae ⅛ to ½ inch thick; single grain; loose; about 2 percent gravel; medium acid.

The thickness of the solum ranges from 40 to 80 inches. The content of pebbles and cobbles ranges from 0 to 10 percent in the solum.

The Ap and A horizons have value of 2 or 3 and chroma of 1 to 3. They are dominantly sandy loam, but the range includes loam and fine sandy loam. The B horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 6. It is sandy loam, loam, sandy clay loam, or loamy sand. Some pedons have a C horizon, which is sand or gravelly sand.

Glendora Series

The Glendora series consists of very poorly drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvial material. Slope is 0 to 1 percent.

The Glendora soils in this county are taxadjuncts because they have more very fine sand in the lower part than is definitive for the series. This difference, however, does not alter the use and management of the soils.

Typical pedon of Glendora loamy fine sand, 905 feet north and 2,310 feet west of the southeast corner of sec. 14, T. 3 N., R. 10 W.

Oa—1 inch to 0; black (10YR 2/1), well decomposed leaf litter and roots; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A—0 to 6 inches; very dark gray (10YR 3/1) loamy fine sand, gray (10YR 5/1) dry; weak medium granular structure; friable; slightly acid; abrupt wavy boundary.

C1—6 to 11 inches; olive gray (5Y 4/2), stratified fine sandy loam and very fine sand; few fine prominent strong brown (7.5YR 4/6) and common medium faint light olive gray (5Y 6/2) mottles; weak medium subangular blocky structure; friable; slightly acid; abrupt wavy boundary.

C2—11 to 22 inches; light brownish gray (10YR 6/2) fine sand; common medium faint pale brown (10YR 6/3) mottles; single grain; loose; mildly alkaline; abrupt smooth boundary.

C3—22 to 26 inches; very dark grayish brown (10YR 3/2) fine sand; single grain; loose; mildly alkaline; abrupt smooth boundary.

C4—26 to 30 inches; olive gray (5Y 5/2) very fine sand; dark grayish brown (2.5Y 4/2) organic stains; common medium distinct olive (5Y 5/6) mottles; single grain; loose; mildly alkaline; clear smooth boundary.

C5—30 to 60 inches; dark grayish brown (2.5Y 4/2) very fine sand; dark gray (5Y 4/1) organic stains; single grain; loose; mildly alkaline.

Free carbonates are below a depth of 18 inches in some pedons. The content of gravel and cobbles is 0 to 3 percent throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes fine sandy loam, loamy sand, fine sand, and sand. The C horizon has hue of 10YR, 5Y, or 2.5Y, value of 2 to 6, and chroma of 1 to 4. It is fine sand, very fine sand, loamy sand, sand, or loamy fine sand.

Granby Series

The Granby series consists of poorly drained, rapidly permeable soils on outwash plains, on lake plains, and in glacial drainageways. These soils formed in sandy material. Slope is 0 to 1 percent.

Typical pedon of Granby sand, 1,950 feet south and 1,780 feet east of the northwest corner of sec. 27, T. 1 N., R. 7 W.

A1—0 to 10 inches; black (10YR 2/1) sand, dark gray (10YR 4/1) dry; moderate fine granular structure; very friable; slightly acid; abrupt smooth boundary.

A2—10 to 15 inches; very dark gray (10YR 3/1) sand, gray (10YR 5/1) dry; common medium and few fine prominent yellowish brown (10YR 5/6) mottles; moderate fine granular structure; very friable; slightly acid; clear wavy boundary.

Bg—15 to 36 inches; dark gray (10YR 4/1) sand; weak medium subangular blocky structure; very friable; slightly acid; clear wavy boundary.

C—36 to 40 inches; yellowish brown (10YR 5/4) sand; many medium distinct dark gray (10YR 4/1) and common fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; neutral; clear wavy boundary.

Cg—40 to 60 inches; grayish brown (10YR 5/2) sand; common medium faint gray (10YR 5/1) mottles; single grain; loose; about 2 percent gravel; neutral.

The thickness of the solum ranges from 24 to 40 inches. 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 sand, but the range includes loamy sand, loamy fine sand, fine sand, sandy loam, and mucky sand. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is sand, loamy sand, loamy fine sand, or fine sand. The C horizon has value of 5 to 7 and chroma of 1 to 4. It is sand, fine sand, or loamy sand.

Houghton Series

The Houghton series consists of very poorly drained soils in swamps, along waterways, and in depressions on till plains, moraines, and outwash plains. These soils formed in deposits of organic material more than 51 inches thick. Permeability is moderately slow to moderately rapid. Slope is 0 to 1 percent.

Typical pedon of Houghton muck, 1,300 feet north and 270 feet east of the southwest corner of sec. 15, T. 1 N., R. 8 W.

Oa1—0 to 14 inches; muck, black (N 2/0) broken face and rubbed; about 15 percent fiber, 3 percent rubbed; moderate fine subangular blocky structure; friable; neutral; clear smooth boundary.

Oa2—14 to 28 inches; muck, black (10YR 2/1) broken face, black (N 2/0) rubbed; about 7 percent fiber, a trace rubbed; moderate fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

Oa3—28 to 35 inches; muck, black (10YR 2/1) broken face, black (N 2/0) rubbed; about 20 percent fiber, 3 percent rubbed; moderate fine subangular blocky structure; friable; mildly alkaline; abrupt smooth boundary.

Oa4—35 to 60 inches; muck, dark reddish brown (5YR 2/2) broken face, black (5YR 2/1) rubbed; about 50 percent fiber, less than 10 percent rubbed; moderate fine subangular blocky structure; friable; mildly alkaline.

The fiber is primarily herbaceous. In some layers, however, as much as 30 percent of the volume is woody material.

The control section has hue of 10YR, 7.5YR, or 5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The layers are predominantly muck, but some pedons have thin layers of mucky peat or peat in the subsurface tier. The combined thickness of the layers of mucky peat is less than 10 inches, and that of the layers of peat is less than 5 inches.

Ithaca Series

The Ithaca series consists of somewhat poorly drained, slowly permeable soils on till plains and moraines. Some of the till plains were modified by glacial lake water. These soils formed in loamy, silty, and clayey material. Slope ranges from 0 to 4 percent.

Typical pedon of Ithaca loam, 0 to 4 percent slopes, 140 feet south and 264 feet west of the northeast corner of sec. 4, T. 4 N., R. 10 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; about 3 percent gravel; slightly acid; abrupt irregular boundary.

B/E—8 to 12 inches; dark brown (7.5YR 4/4) silty clay (B); brown (10YR 5/3) loam (E) interfingering into peds of B material, very pale brown (10YR 7/3) dry; common fine distinct dark gray (N 4/0) and gray (N 5/0), common fine prominent gray (5Y 5/1), and common medium distinct strong brown (7.5YR 5/8) mottles; moderate medium and fine subangular blocky structure; firm; about 3 percent gravel; neutral; clear wavy boundary.

Bt—12 to 22 inches; dark brown (7.5YR 4/4) silty clay; many medium distinct strong brown (7.5YR 5/8 and 4/6) and common fine distinct brown (7.5YR 4/2) mottles; moderate very thick platy structure parting to strong medium and fine angular blocky; very firm; many prominent dark gray (10YR 4/1) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

BC—22 to 29 inches; brown (7.5YR 5/4) silty clay loam; many fine prominent greenish gray (5G 5/1) and many medium prominent strong brown (7.5YR 5/8) mottles; moderate thick platy structure parting to strong fine angular blocky; firm; common prominent dark brown (7.5YR 4/2 and 3/2) clay films on faces of peds; about 3 percent gravel; mildly alkaline; clear wavy boundary.

C—29 to 60 inches; brown (7.5YR 5/4) silty clay loam; many fine prominent greenish gray (5G 5/1) and many medium distinct strong brown (7.5YR 5/8) mottles; moderate thick platy structure parting to strong fine angular blocky; firm; light gray (10YR 7/1) lime filaments; about 3 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. It coincides with the depth to free carbonates. The content of gravel and cobbles ranges from 2 to 10 percent throughout the profile.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam. The B horizon has hue of 5YR, 7.5YR, or 10YR and value of 4 or 5. It is silty clay, silty clay loam, or clay loam. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is clay loam or silty clay loam.

Kalamazoo Series

The Kalamazoo series consists of well drained soils on outwash plains and moraines. These soils formed in loamy material underlain by sand and gravel. Permeability is moderate in the upper part of the pedon and rapid in the lower part. Slope ranges from 0 to 18 percent.

Typical pedon of Kalamazoo loam, 2 to 6 percent slopes, 2,580 feet south and 1,580 feet west of the northeast corner of sec. 33, T. 1 N., R. 9 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; friable; about 2 percent gravel; neutral; abrupt smooth boundary.

Bt1—10 to 17 inches; brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; common faint dark brown (7.5YR 3/4) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

Bt2—17 to 24 inches; brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure; firm; many faint dark brown (7.5YR 3/4) clay films on faces of peds and around coarse fragments; about 20 percent gravel and cobbles; medium acid; clear wavy boundary.

Bt3—24 to 34 inches; brown (7.5YR 4/4) gravelly sandy loam; moderate medium subangular blocky structure; friable; common faint dark brown (7.5YR 3/4) clay films on faces of peds and around coarse fragments; about 25 percent gravel and cobbles; neutral; clear wavy boundary.

2BC—34 to 44 inches; brown (7.5YR 4/4) gravelly loamy sand; weak fine subangular blocky structure parting to single grain; very friable; few faint dark brown (7.5YR 3/4) clay films; about 30 percent gravel and cobbles; neutral; abrupt wavy boundary.

2C—44 to 60 inches; yellowish brown (10YR 5/4), stratified sand and gravel; single grain; loose; about 25 percent gravel; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. The content of pebbles and cobbles ranges from 0 to 25 percent in the solum and from 0 to 60 percent in the 2C horizon.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly loam, but the range includes sandy loam. The Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. It is gravelly sandy clay loam, sandy clay loam, gravelly sandy loam, sandy loam, clay loam, or loam. The 2C horizon has value of 4 to 6 and chroma of 3 to 6. It is stratified sand and gravel, sand, or gravelly sand.

Kibbie Series

The Kibbie series consists of somewhat poorly drained, moderately permeable soils on lake plains, till plains, and outwash plains. These soils formed in stratified, loamy and silty material. Slope ranges from 0 to 4 percent.

The Kibbie soils in this county are taxadjuncts because they have a thicker epipedon than is definitive for the series. This difference, however, does not alter the use and management of the soils.

Typical pedon of Kibbie silt loam, 0 to 4 percent slopes, 2,570 feet north and 1,637 feet west of the southeast corner of sec. 35, T. 2 N., R. 8 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; strong medium granular structure; firm; neutral; abrupt wavy boundary.

Bt1—9 to 18 inches; light olive brown (2.5Y 5/4) clay loam; many fine prominent gray (5Y 5/1) and common fine prominent dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) mottles; moderate medium angular blocky structure; firm; common prominent dark grayish brown (10YR 4/2) clay films on faces of peds; mildly alkaline; clear wavy boundary.

Bt2—18 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/8) mottles; moderate very thick platy structure parting to moderate fine angular blocky; firm; common distinct dark brown (10YR 4/3) clay films on faces of peds; mildly alkaline; clear wavy boundary.

C—24 to 60 inches; light olive brown (2.5Y 5/4), stratified silty clay loam, silt loam, and silt; many medium prominent grayish brown (10YR 5/2) and common medium prominent yellowish brown (10YR 5/6) mottles; weak very thick platy structure parting to moderate fine angular blocky; firm; light gray (10YR 7/2) calcium carbonate streaks; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 40 inches. The Ap horizon has value of 2 or 3 and chroma of 1 to 3. It is dominantly silt loam, but the range includes loam and very fine sandy loam. The B horizon has value of 4 or 5 and chroma of 3 to 6. It is loam, clay loam, silty clay loam, or silt loam. The C horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 2 to 4. It is stratified clay to very fine sand. The texture varies within short horizontal distances.

Lenawee Series

The Lenawee series consists of poorly drained, slowly permeable soils on lake plains and in depressional areas on moraines. These soils formed in stratified, silty and clayey material. Slope ranges from 0 to 2 percent.

Typical pedon of Lenawee silty clay loam, 1,452 feet north and 2,480 feet west of the southeast corner of sec. 23, T. 4 N., R. 9 W.

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; moderate very thick platy structure; firm; neutral; abrupt wavy boundary.

Bg1—7 to 12 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 6/1) dry; many medium faint dark grayish brown (10YR 4/2) and common fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium angular blocky structure; firm; mildly alkaline; abrupt wavy boundary.

Bg2—12 to 20 inches; gray (5Y 5/1) silty clay; common fine prominent yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8) and many medium distinct olive (5Y 4/3) mottles; strong coarse angular blocky structure; very firm; mildly alkaline; clear wavy boundary.

BC—20 to 23 inches; olive (5Y 4/3) silty clay; many medium faint olive gray (5Y 5/2) and common fine prominent strong brown (7.5YR 5/8) mottles; weak coarse angular blocky structure; very firm; strong effervescence; moderately alkaline; clear wavy boundary.

C—23 to 60 inches; olive (5Y 4/3) silty clay loam; many medium faint olive gray (5Y 4/2) and common fine prominent strong brown (7.5YR 5/8) mottles; massive; very firm; light gray (10YR 7/1) calcium carbonate streaks; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 23 to 40 inches. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes loam and clay loam. The Bg horizon has hue of 5Y, 2.5Y, or 10YR, value of 3 to 6, and chroma of 1 or 2. It is dominantly silty clay loam, silty clay, or clay loam but is commonly stratified with clay, silt loam, or very fine sand. The C horizon has hue of 10YR, 5Y, 2.5Y, or 5GY, value of 4 to 6, and chroma of 1 to 6. It is dominantly silty clay loam, clay loam, or silt loam but is commonly stratified with silty clay, clay, or very fine sand.

Marlette Series

The Marlette series consists of well drained and moderately well drained, moderately slowly permeable soils on till plains and moraines. These soils formed in loamy material. Slope ranges from 0 to 40 percent.

Typical pedon of Marlette loam, 2 to 6 percent slopes, 1,500 feet north and 130 feet east of the southwest corner of sec. 1, T. 3 N., R. 7 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; weak coarse granular structure; friable; about 2 percent gravel; neutral; abrupt smooth boundary.

E/B—9 to 15 inches; pale brown (10YR 6/3) fine sandy loam (E), very pale brown (10YR 7/3) dry; surrounding peds of dark yellowish brown (10YR 4/4) loam (Bt); moderate medium subangular blocky structure; friable; common distinct dark brown (7.5YR 3/4) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

B/E—15 to 25 inches; dark yellowish brown (10YR 4/4) loam (Bt); pale brown (10YR 6/3) fine sandy loam (E) interfingering into peds of Bt material, very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; friable; common prominent dark brown (7.5YR 3/4) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

Bt1—25 to 30 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure parting to weak fine subangular; firm; many prominent dark brown (7.5YR 3/4) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

Bt2—30 to 34 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common prominent dark brown (7.5YR 3/4) clay films on faces of peds; about 2 percent gravel; mildly alkaline; clear wavy boundary.

C—34 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; about 2 percent gravel; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 25 to 40 inches. It coincides with the depth to free carbonates. The content of gravel and cobbles ranges from 2 to 10 percent throughout the profile.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly loam or fine sandy loam, but the range includes sandy loam. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, clay loam, or silty clay loam. In areas where the soils are well drained, low-chroma mottles are below a depth of 20 inches and high-chroma mottles are throughout the B horizon. The C horizon has value of 4 to 6 and chroma of 2 to 4. It is loam or clay loam.

Matherton Series

The Matherton series consists of somewhat poorly drained soils on terraces and outwash plains. These soils formed in loamy material underlain by sandy and loamy material. Permeability is moderate in the upper part of the pedon, very rapid in the next part, and moderately slow in the lower part. Slope ranges from 0 to 4 percent.

Typical pedon of Matherton loam, loamy substratum, 0 to 4 percent slopes, 440 feet north and 2,375 feet west of the southeast corner of sec. 19, T. 4 N., R. 10 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

Btg—9 to 21 inches; grayish brown (10YR 5/2) clay loam; common fine and medium prominent strong brown (7.5YR 4/6 and 5/8) mottles; weak medium prismatic structure parting to moderate fine angular blocky; very firm; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; about 3 percent gravel; neutral; abrupt irregular boundary.

2Bt1—21 to 24 inches; dark yellowish brown (10YR 4/4) sandy loam; common medium prominent dark brown (7.5YR 4/2) and common fine prominent strong brown (7.5YR 4/6 and 7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; common faint dark brown (7.5YR 4/2) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2Bt2—24 to 28 inches; yellowish brown (10YR 5/4) loamy coarse sand; common medium distinct grayish brown (10YR 5/2) and common medium prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; friable; common prominent dark brown (7.5YR 4/4) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2BC—28 to 37 inches; yellowish brown (10YR 5/4) loamy coarse sand; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; very friable; about 5 percent gravel; neutral; clear wavy boundary.

2C1—37 to 57 inches; brown (10YR 5/3) coarse sand; many medium prominent yellowish brown (10YR 5/8) mottles; single grain; loose; about 10 percent gravel and cobbles; slight effervescence; moderately alkaline; abrupt wavy boundary.

3C2—57 to 64 inches; reddish brown (5YR 5/3) clay loam; massive; firm; about 3 percent gravel; strong effervescence; moderately alkaline; abrupt wavy boundary.

3C3—64 to 74 inches; dark brown (7.5YR 4/2) clay loam; massive; very firm; about 3 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is sandy clay loam, clay loam, loam, gravelly sandy clay loam, or gravelly loam. The 2B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is sandy loam or loamy coarse sand. The 2C horizon has value of 5 to 7 and chroma of 1 to 4. It is gravelly sand, stratified sand and gravelly sand, or coarse sand. The 3C horizon is clay loam, silty clay loam, clay, or silty clay.

Oshtemo Series

The Oshtemo series consists of well drained soils on outwash plains and moraines. These soils formed in loamy material and in the underlying sand and gravel. Permeability is moderately rapid in the upper part of the pedon and very rapid in the lower part. Slope ranges from 0 to 40 percent.

Typical pedon of Oshtemo sandy loam, 0 to 6 percent slopes, 2,525 feet south and 1,100 feet east of the northwest corner of sec. 33, T. 1 N., R. 9 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; moderate very thick platy structure parting to moderate very fine subangular blocky; friable; about 2 percent pebbles; neutral; abrupt smooth boundary.

Bt1—9 to 15 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; common distinct strong brown (7.5YR 4/6) clay films on faces of peds; about 10 percent pebbles and cobbles; slightly acid; clear wavy boundary.

Bt2—15 to 23 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common faint strong brown (7.5YR 4/6) clay films on faces of peds; about 5 percent pebbles; strongly acid; clear wavy boundary.

Bt3—23 to 30 inches; dark brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; common clay bridges between sand grains; about 10 percent pebbles and cobbles; strongly acid; gradual wavy boundary.

E&Bt1—30 to 37 inches; strong brown (7.5YR 5/6) sand (E); strong brown (7.5YR 4/6) lamellae of loamy sand 1/8 to 1/2 inch thick (Bt); weak fine subangular blocky structure parting to single grain; very friable; about 3 percent pebbles; strongly acid; clear wavy boundary.

E&Bt2—37 to 60 inches; yellowish brown (10YR 5/6) sand (E); strong brown (7.5YR 4/6) lamellae of loamy sand 1/8 to 1/2 inch thick (Bt); single grain; loose; about 1 percent pebbles; slightly acid; abrupt wavy boundary.

2C—60 to 80 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; about 25 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to more than 70 inches. The content of gravel and cobbles ranges from 0 to 15 percent in the solum and from 0 to 60 percent in the 2C horizon.

The A horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly sandy loam, but the range includes loamy sand. The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 to 6. It is sandy loam, sandy clay loam, gravelly sandy clay loam, or loamy sand and averages less than 18 percent clay. Some pedons have a BC horizon, which is sand or loamy sand. The 2C horizon has value of 5 or 6 and chroma of 2 to 4. It is gravelly sand, sand, or gravel.

Palms Series

The Palms series consists of very poorly drained soils in swamps, along waterways, and in depressions on till plains, moraines, and outwash plains. These soils formed in deposits of organic material 16 to 50 inches deep over loamy material. Permeability is moderately slow to moderately rapid in the upper part of the pedon and moderate or moderately slow in the lower part. Slope is 0 to 1 percent.

Typical pedon of Palms muck, 40 feet south and 100 feet west of the northeast corner of sec. 17, T. 1 N., R. 7 W.

Oa1—0 to 11 inches; muck, black (N 2/0) broken face and rubbed; about 40 percent fiber, 5 percent rubbed; moderate coarse subangular blocky structure; friable; strongly acid; clear wavy boundary.

Oa2—11 to 32 inches; muck, black (5YR 2/1) broken face and rubbed; about 10 percent fiber, 1 percent rubbed; moderate thick platy structure parting to moderate fine subangular blocky; friable; medium acid; abrupt wavy boundary.

Cg1—32 to 37 inches; gray (5Y 5/1) loam; massive; friable; slightly acid; clear wavy boundary.

Cg2—37 to 60 inches; greenish gray (5GY 5/1) silt loam; massive; friable; mildly alkaline.

Depth to the loamy 2C horizon ranges from 16 to 50 inches. The organic material is primarily herbaceous, but in some pedons as much as 15 percent of the volume is woody material. The organic layers are predominantly muck, but some pedons have thin layers of mucky peat or peat.

The surface tier has hue of 10YR, 7.5YR, or 5YR or is neutral in hue. It has chroma of 0 to 2. The subsurface and bottom tiers have hue of 10YR, 7.5YR, or 5YR or are neutral in hue. They have value of 2 to 4 and chroma of 0 to 2. The 2C horizon has hue of 2.5Y, 5Y, or 5GY, value of 3 to 7, and chroma of 1 or 2. It is silt loam, loam, sandy loam, fine sandy loam, clay loam, or silty clay loam.

Parkhill Series

The Parkhill series consists of poorly drained, moderately slowly permeable soils on till plains and moraines. These soils formed in loamy and silty material. Slope ranges from 0 to 2 percent.

Typical pedon of Parkhill loam, 265 feet south and 30 feet east of the northwest corner of sec. 28, T. 4 N., R. 7 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate coarse granular structure; friable; about 1 percent gravel; neutral; abrupt smooth boundary.

Bg1—8 to 12 inches; gray (10YR 5/1) clay loam; common medium prominent yellowish brown (10YR 5/6) and common coarse faint dark gray (10YR 4/1) mottles; moderate medium subangular blocky structure; firm; about 1 percent gravel; mildly alkaline; clear wavy boundary.

Bg2—12 to 19 inches; gray (10YR 5/1) silty clay loam; moderate medium prominent yellowish brown (10YR 5/6) mottles; strong medium angular blocky structure; firm; about 1 percent gravel; mildly alkaline; clear wavy boundary.

BCg—19 to 25 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR 5/6) and common medium faint gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; about 1 percent gravel; mildly alkaline; clear wavy boundary.

Cg—25 to 60 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR

5/6) and common medium faint gray (10YR 5/1) mottles; massive; friable; about 3 percent gravel; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 22 to 36 inches. The content of gravel and cobbles ranges from 0 to 10 percent throughout the profile.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The B and C horizons have hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. The C horizon is loam or silt loam.

Perrinton Series

The Perrinton series consists of well drained and moderately well drained, slowly permeable soils on till plains and moraines. These soils formed in silty and clayey material. Slope ranges from 1 to 40 percent.

Typical pedon of Perrinton loam, moderately wet, 1 to 8 percent slopes, 1,360 feet east and 320 feet south of the northwest corner of sec. 3, T. 4 N., R. 10 W.

Ap—0 to 8 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 5/2) dry; moderate fine subangular blocky structure; friable; about 2 percent gravel; neutral; abrupt smooth boundary.

B/E—8 to 14 inches; dark brown (7.5YR 4/4) silty clay loam (B), light brownish gray (10YR 6/2) loam (E) interfingering into peds of Bt material, light gray (10YR 7/2) dry; common medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; few fine prominent black (N 2/0) manganese concretions less than 2 millimeters wide; strong medium subangular blocky structure; firm; many faint dark brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

Bt1—14 to 21 inches; dark brown (7.5YR 4/4) silty clay; common fine distinct strong brown (7.5YR 5/8) mottles; few fine prominent black (N 2/0) manganese concretions less than 2 millimeters wide; strong coarse subangular blocky structure; firm; many faint dark brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; mildly alkaline; gradual wavy boundary.

Bt2—21 to 26 inches; dark brown (7.5YR 4/4) silty clay; many coarse prominent greenish gray (5G 5/1) coatings on faces of peds and common fine prominent strong brown (7.5YR 5/8) mottles; weak thick platy structure parting to moderate fine angular blocky; firm; many faint dark brown (10YR 4/3) clay films on faces of peds; about 2 percent gravel; mildly alkaline; clear wavy boundary.

C—26 to 60 inches; brown (7.5YR 5/4) silty clay loam; many coarse distinct brown (7.5YR 5/2) and common medium distinct strong brown (7.5YR 5/8) mottles; moderate very thick platy structure parting to moderate medium angular blocky; firm; light gray (10YR 7/1) lime filaments; about 2 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 36 inches. It coincides with the depth to free carbonates. The content of gravel and cobbles ranges from 2 to 10 percent throughout the profile.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 1 to 3. It is dominantly loam, but the range includes silt loam. The E part of the B/E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is dominantly loam, but the range includes silt loam. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam, silty clay loam, clay, or silty clay. In areas where the soils are well drained, there are no mottles or manganese concretions within a depth of 40 inches. The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or clay loam.

Schoolcraft Series

The Schoolcraft series consists of well drained soils on outwash plains. These soils formed in loamy material underlain by sand and gravel. Permeability is moderate in the upper part of the pedon and rapid in the lower part. Slope ranges from 0 to 6 percent.

Typical pedon of Schoolcraft loam, 0 to 2 percent slopes, 660 feet south and 2,470 feet west of the northeast corner of sec. 33, T. 4 N., R. 10 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure parting to moderate fine granular; friable; about 3 percent gravel; neutral; abrupt wavy boundary.

AB—10 to 15 inches; mixed black (10YR 2/1), very dark grayish brown (10YR 3/2), and dark brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; about 10 percent gravel and cobbles; neutral; abrupt wavy boundary.

Bt1—15 to 27 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; common distinct dark brown (7.5YR 3/2 and 4/2) clay films on faces of peds; about 10 percent gravel and cobbles; neutral; clear wavy boundary.

Bt2—27 to 36 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; many distinct dark brown (7.5YR 3/2) clay films on faces of peds; about 10 percent gravel and cobbles; neutral; clear wavy boundary.

2BC—36 to 50 inches; dark yellowish brown (10YR 4/4) loamy sand; moderate fine subangular blocky structure; friable; common distinct dark brown (7.5YR 3/2) clay films on faces of peds; about 10 percent gravel and cobbles; neutral; abrupt wavy boundary.

2C—50 to 60 inches; strong brown (7.5YR 4/6), stratified sand and gravel; single grain; loose; about 20 percent gravel; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches. The content of gravel and cobbles ranges from 0 to 10 percent in the solum and from 0 to 20 percent in the 2C horizon.

The A horizon is dominantly loam, but the range includes silt loam and sandy loam. The Bt horizon has value of 3 to 5 and chroma of 2 to 4. It is loam, sandy clay loam, or clay loam in the upper part. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6.

Sebewa Series

The Sebewa series consists of poorly drained soils on terraces and outwash plains. These soils formed in loamy and silty material underlain by sandy and silty material. Permeability is moderate in the upper part of the pedon, rapid in the next part, and very slow in the lower part. Slope ranges from 0 to 2 percent.

The Sebewa soils in this county are taxadjuncts because they have a thinner surface layer and less gravel in the substratum than is definitive for the series. These differences, however, do not alter the use and management of the soils.

Typical pedon of Sebewa loam, loamy substratum, 600 feet south and 2,500 feet east of the northwest corner of sec. 30, T. 4 N., R. 10 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; common fine prominent strong brown (7.5YR 4/6) mottles at the base of the horizon; moderate coarse granular structure; friable; about 3 percent gravel; slightly acid; abrupt smooth boundary.

Eg—8 to 10 inches; grayish brown (10YR 5/2) loam; common fine prominent yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; friable; about 8 percent gravel and cobbles; slightly acid; abrupt wavy boundary.

Btg1—10 to 21 inches; gray (N 5/0) silty clay loam; common medium prominent yellowish brown (10YR 5/6 and 5/8) mottles; moderate coarse subangular blocky structure; very firm; many faint dark gray (N 4/0) clay films on faces of peds; about 5 percent gravel; neutral; abrupt wavy boundary.

2Btg2—21 to 29 inches; dark gray (5Y 4/1) sandy clay loam; common fine prominent greenish gray (5BG 5/1 and 6/1) and many medium prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; common clay bridges; about 8 percent gravel and cobbles; mildly alkaline; abrupt wavy boundary.

3C1—29 to 42 inches; yellowish brown (10YR 5/8) coarse sand; single grain; loose; about 8 percent gravel and cobbles; strong effervescence; moderately alkaline; abrupt wavy boundary.

4C2—42 to 48 inches; yellowish brown (10YR 5/4) silty clay loam; massive; very firm; about 3 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

4Cg—48 to 60 inches; dark brown (7.5YR 4/2) silty clay loam; massive; very firm; about 1 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. It coincides with the depth to free carbonates.

The Ap 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 and sandy loam. The content of gravel and cobbles in this horizon ranges from 0 to 10 percent. The B horizon has hue of 10YR, 2.5Y, or 5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It is silty clay loam, coarse sandy clay loam, sandy clay loam, loam, clay loam, or gravelly clay loam. The content of gravel and cobbles in this horizon ranges from 5 to 25 percent. The 3C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 8. It is coarse sand, gravelly sand, or stratified sand and gravel. The content of gravel and cobbles in this horizon ranges from 8 to 60 percent. The 4C horizon is silty clay loam, clay loam, or silty clay.

Selfridge Series

The Selfridge series consists of somewhat poorly drained soils on moraines, till plains, and lake plains.

These soils formed in sandy 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.

Typical pedon of Selfridge loamy sand, 0 to 4 percent slopes, 1,060 feet south and 65 feet east of the northwest corner of sec. 17, T. 4 N., R. 7 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; moderate fine granular structure; very friable; slightly acid; abrupt smooth boundary.

E1—7 to 12 inches; yellowish brown (10YR 5/4) sand; few fine distinct yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure parting to single grain; very friable; strongly acid; clear wavy boundary.

E2—12 to 18 inches; brown (10YR 5/3) sand; common medium faint light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) and few fine prominent yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure parting to single grain; very friable; strongly acid; clear wavy boundary.

Bw—18 to 28 inches; yellowish brown (10YR 5/4) loamy fine sand; common coarse distinct light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) and common medium prominent strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; friable; about 1 percent gravel; strongly acid; clear irregular boundary.

2Bt1—28 to 37 inches; brown (7.5YR 5/4) clay loam; common medium distinct strong brown (7.5YR 4/6 and 5/8) and many medium prominent gray (5Y 6/1) mottles; moderate medium subangular blocky structure; firm; common distinct dark brown (7.5YR 4/2) clay films on faces of peds; about 2 percent gravel; strongly acid; clear irregular boundary.

2Bt2—37 to 47 inches; brown (7.5YR 5/4) sandy clay loam; common fine prominent grayish brown (10YR 5/2) and common medium prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; common distinct dark brown (7.5YR 4/2) clay films on faces of peds; about 7 percent gravel and cobbles; strongly acid; clear wavy boundary.

2C—47 to 60 inches; brown (7.5YR 5/4) loam; common medium distinct gray (N 6/0) and common medium prominent brownish yellow (10YR 6/8) mottles; weak medium subangular blocky structure; firm; about 3 percent gravel; strongly acid.

The thickness of the solum ranges from 24 to 50 inches. The content of gravel and cobbles ranges from 0 to 5 percent in the upper part of the solum and from 0 to 10 percent in the lower part.

The Ap horizon has value of 2 to 4 and chroma of 1 to 3. It is dominantly loamy sand, but the range includes sand, fine sand, and loamy fine sand. The E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. The Bw horizon has value of 4 to 6 and chroma of 3 or 4. The E and Bw horizons are sand, fine sand, loamy sand, or loamy fine sand. The 2Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 4. It is clay loam, sandy clay loam, loam, or silty clay loam. The 2C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 to 4. It is loam, clay loam, or silty clay loam.

Sloan Series

The Sloan series consists of very poorly drained soils on flood plains. These soils formed in loamy alluvial material underlain by sand. Permeability is moderate in the upper part of the pedon and rapid in the lower part. Slope is 0 to 1 percent.

Typical pedon of Sloan loam, sandy substratum, 1,100 feet north and 1,900 feet west of the southeast corner of sec. 20, T. 3 N., R. 7 W.

A1—0 to 2 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; mildly alkaline; abrupt wavy boundary.

A2—2 to 6 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; common medium faint dark gray (10YR 4/1) and common medium and fine prominent strong brown (7.5YR 4/6) mottles; moderate medium subangular blocky structure; friable; mildly alkaline; abrupt wavy boundary.

A3—6 to 20 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; many medium prominent gray (N 5/0) and common medium prominent dark reddish brown (5YR 3/4) mottles; moderate medium subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

Bg1—20 to 25 inches; dark gray (10YR 4/1), stratified clay loam and sandy loam; very dark gray (10YR 3/1) organic stains; common medium prominent dark reddish brown (5YR 3/4) and few fine prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; moderately alkaline; gradual wavy boundary.

Bg2—25 to 34 inches; dark grayish brown (10YR 4/2) clay loam; common medium and coarse prominent gray (5Y 5/1) and common fine prominent dark brown (7.5YR 4/4) and dark reddish brown (5YR 3/4) mottles; moderate medium subangular blocky structure; friable; moderately alkaline; abrupt wavy boundary.

Ab—34 to 48 inches; black (10YR 2/1) sandy loam; massive; friable; strong effervescence; moderately alkaline; abrupt wavy boundary.

2Cg—48 to 60 inches; dark gray (10YR 4/1) sand; single grain; loose; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The content of gravel and cobbles ranges from 0 to 5 percent in the solum and from 0 to 20 percent in the 2C horizon.

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 loam, but the range includes silt loam and silty clay loam. The B horizon has hue of 10YR or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 2. It is loam, silt loam, clay loam, or silty clay loam. Some pedons do not have an Ab horizon. The 2Cg horizon is coarse sand, sand, or gravelly sand.

Spinks Series

The Spinks series consists of well drained, moderately rapidly permeable soils on outwash plains and moraines. These soils formed in sandy material. Slope ranges from 0 to 40 percent.

Typical pedon of Spinks loamy sand, 12 to 18 percent slopes, 140 feet north and 1,900 feet west of the southeast corner of sec. 23, T. 4 N., R. 10 W.

Ap—0 to 11 inches; dark brown (10YR 4/3) loamy sand, brown (10YR 5/3) dry; weak fine subangular blocky structure; very friable; about 1 percent gravel; neutral; abrupt smooth boundary.

E1—11 to 16 inches; yellowish brown (10YR 5/6) sand; weak fine subangular blocky structure parting to single grain; very friable; about 1 percent gravel; medium acid; clear smooth boundary.

E2—16 to 28 inches; yellowish brown (10YR 5/6) sand; weak fine subangular blocky structure parting to single grain; very friable; about 10 percent gravel and cobbles; slightly acid; abrupt broken boundary.

E&Bt1—28 to 35 inches; yellowish brown (10YR 5/6) sand (E); single grain; loose; lamellae of dark brown (7.5YR 4/4) loamy sand (Bt); weak very fine subangular blocky structure; very friable; clay bridges and coatings in the Bt part; about 10 percent gravel and cobbles; slightly acid; abrupt wavy boundary.

E&Bt2—35 to 60 inches; yellowish brown (10YR 5/4) sand (E); single grain; loose; lamellae of dark brown (7.5YR 4/4) loamy sand (Bt); weak fine subangular blocky structure; very friable; clay bridges and coatings in the Bt part; about 1 percent gravel; neutral.

The thickness of the solum ranges from 36 to more than 60 inches. The content of gravel and cobbles ranges from 0 to 15 percent throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is dominantly loamy sand, but the range includes loamy fine sand, fine sand, and sand. The E horizon has value of 4 to 6 and chroma of 3 to 8. It is sand, fine sand, loamy fine sand, or loamy sand. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sand, loamy sand, loamy fine sand, or sandy loam. The cumulative thickness of the Bt lamellae is more than 6 inches. The C horizon, if it occurs, has hue of 10YR, value of 5 to 7, and chroma of 3 or 4. It is sand or fine sand.

Tekenink Series

The Tekenink series consists of well drained, moderately permeable soils on till plains and moraines. These soils formed in loamy material. Slope ranges from 1 to 40 percent.

Typical pedon of Tekenink fine sandy loam, 6 to 12 percent slopes, 1,755 feet south and 110 feet west of the northeast corner of sec. 2, T. 2 N., R. 10 W.

Oa—1 inch to 0; partially decomposed leaves and twigs; medium acid; abrupt smooth boundary.

Ap—0 to 8 inches; dark brown (10YR 4/3) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; about 11 percent gravel and cobbles; strongly acid; abrupt smooth boundary.

E—8 to 14 inches; yellowish brown (10YR 5/4) fine sandy loam; moderate medium subangular blocky structure; friable; about 9 percent gravel and cobbles; strongly acid; clear wavy boundary.

B/E1—14 to 21 inches; strong brown (7.5YR 4/6) fine sandy loam (Bt); yellowish brown (10YR 5/4) fine sandy loam (E) interfingering into peds of Bt material, very pale brown (10YR 7/3) dry; moderate fine subangular blocky structure; firm; many prominent dark brown (7.5YR 4/4) clay films on faces of peds; about 7 percent gravel; strongly acid; clear wavy boundary.

B/E2—21 to 52 inches; strong brown (7.5YR 4/6) fine sandy loam (Bt); yellowish brown (10YR 5/4) fine sandy loam (E) interfingering into peds of Bt material, very pale brown (10YR 7/3) dry; moderate thick platy structure parting to moderate fine subangular blocky; firm; many prominent dark brown clay films on faces of peds; about 12 percent gravel and cobbles; strongly acid; abrupt wavy boundary.

C—52 to 60 inches; yellowish brown (10YR 5/4) loamy sand; moderate thick platy structure parting to moderate fine subangular blocky; friable; about 11 percent gravel and cobbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. The content of pebbles and cobbles ranges from 0 to 15 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. It is dominantly fine sandy loam, but the range includes sandy loam, loamy sand, and loamy fine sand. The E horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 4. It is fine sandy loam, sandy loam, loamy fine sand, or loamy sand. The E part of the B/E horizon has the same color and texture as the E horizon. The B part of the B/E horizon and the Bt horizon, if it occurs, have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The B horizon is sandy loam, fine sandy loam, loam, or sandy clay loam. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is sandy loam, loamy sand, fine sandy loam, or loamy fine sand.

Thetford Series

The Thetford series consists of somewhat poorly drained, moderately rapidly permeable soils on terraces, outwash plains, and moraines. These soils formed in sandy material. Slope ranges from 0 to 3 percent.

Typical pedon of Thetford loamy sand, 0 to 3 percent slopes, 660 feet north and 1,856 feet west of the southeast corner of sec. 36, T. 4 N., R. 9 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; moderate medium granular structure; very friable; slightly acid; abrupt wavy boundary.

Bw1—8 to 14 inches; yellowish brown (10YR 5/4) loamy sand; weak fine subangular blocky structure; very friable; medium acid; clear wavy boundary.

Bw2—14 to 22 inches; light yellowish brown (10YR 6/4) sand; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure parting to single grain; very friable; about 2 percent gravel; strongly acid; clear wavy boundary.

E&Bt1—22 to 35 inches; light yellowish brown (10YR 6/4) sand (E) and strong brown (7.5YR 4/6) loamy sand (Bt); common medium distinct light brownish gray (10YR 6/2) and common medium prominent strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure parting to single grain; very friable; common distinct clay bridges between sand grains; about 3 percent gravel; strongly acid; clear wavy boundary.

E&Bt2—35 to 58 inches; very pale brown (10YR 7/3) sand (E) and yellowish red (5YR 4/6) loamy sand (Bt); few fine faint light brownish gray (10YR 6/2) and many fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure parting to single grain; very friable; common distinct clay bridges between sand grains; about 7 percent gravel and cobbles; strongly acid; clear wavy boundary.

E&Bt3—58 to 62 inches; light yellowish brown (10YR 6/4) sand (E) and yellowish red (5YR 4/6) sandy loam (Bt); common fine distinct light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; friable; common distinct clay bridges between sand grains; about 7 percent gravel and cobbles; strongly acid.

The thickness of the solum ranges from 35 to more than 60 inches. The content of gravel and cobbles ranges from 0 to 10 percent in the solum.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly loamy sand, but the range includes sand, fine sand, and loamy fine sand. The Bw horizon and the E part of the E&Bt horizon are sand, fine sand, loamy sand, or loamy fine sand. The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. The E part of the E&Bt horizon has value of 4 to 7 and chroma of 3 or 4. The Bt part has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 to 6. It is loamy sand, loamy fine sand, or sandy loam. Some pedons have an AC horizon. This horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4. It is sand or fine sand.

Formation of the Soils

This section relates the factors and processes of soil formation to the soils in the survey area.

Factors of Soil Formation

Soil formation is determined by the interaction of five major factors: the physical, chemical, and mineral composition 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 *(6)*.

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 living organisms are modified by relief. The nature of the parent material affects the kind of soil profile that forms. In extreme cases, it determines the soil profile entirely. Finally, time is needed for the transformation of the parent material into a soil. Some time is always required 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 chemical and mineralogical composition of the soil. The parent materials of the soils in Barry County were deposited by glaciers or by glacial meltwater. The glaciers covered the county 10,000 to 12,000 years ago. Some of these materials have been reworked and redeposited by the subsequent action of water and wind. Although the parent materials in Barry County are of common glacial origin, their properties vary greatly, sometimes within a small area, depending on how the materials were deposited. The dominant parent materials in Barry County were deposited as glacial till, outwash material, alluvium, and organic material.

Glacial till is material that was deposited directly by the 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 Barry County generally is calcareous sandy loam or loam. The soils that formed in this till typically are moderately coarse textured to moderately fine textured and have a well developed subsoil. Marlette and Tekenink soils are examples.

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 them. As the speed of the stream decreased, the coarser particles were deposited first. Only 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 sand, gravel, and other coarse particles. Oshtemo soils are an example of soils that formed in deposits of outwash material.

Alluvium is material that has recently been deposited by floodwater from streams. This material varies in texture, depending on the speed of the water from which it was deposited. The alluvium deposited along a swift stream is coarser textured than that deposited by a slow, sluggish stream. Sloan soils are an example of soils that formed in alluvium.

Organic material is made up of accumulated plant remains. After the glaciers receded, water was left standing in depressions on outwash plains, flood plains, moraines, and till plains. Grasses, sedges, and water-tolerant plants grew around the edges of these lakes. When these plants died, their residue did not decompose because the areas were wet. Later, water-tolerant trees grew in the areas. After these trees died, their residue became part of the organic accumulation. Eventually, the lakes were filled with organic material and developed into areas of muck. Houghton soils are an example of soils that formed in organic material.

Plant and Animal Life

Green plants have been the principal organisms influencing the soils in Barry County. Bacteria, fungi, earthworms, and human activities also have been important. The chief contribution of plant and animal life to soil formation is the addition of organic material and nitrogen to the soil. The kind of organic material on the soil depends on the kinds of native 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 created channels through which water moved into the soil. They also added organic matter as they decayed. Bacteria in the soil helped to break down the organic matter so that it could be used by growing plants.

The original vegetation in Barry County was mainly deciduous trees. Differences in natural soil drainage and minor variations in the parent material affected the composition of the forest species. The well drained soils on uplands, such as Kalamazoo and Oshtemo soils, were covered mainly by maple, oak, and hickory. The wet soils were covered mainly by soft maple, elm, and ash.

Climate

Climate determines the kind of plant and animal life on and in the soil. It also determines the amount of water available for weathering minerals and for the translocation of soil material. Climate influences temperature, thus affecting the rate of chemical reaction in the soil.

The climate in Barry County is cool and humid. It is presumably similar to that under which the soils formed. It is uniform throughout the county. Only minor differences among the soils in the county are the result of differences in climate.

Relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. In Barry County, slopes range from 0 to 40 percent. Runoff is rapid on the steeper slopes. Water temporarily ponds in low areas.

The soils in Barry County range from excessively drained on sandy ridgetops to very poorly drained in 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 Kalamazoo soils and other soils that are excessively drained to well drained and are well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized. Sebewa soils and other soils that are poorly drained and poorly aerated are dull gray and mottled. The Kalamazoo and Sebewa soils formed in similar kinds of parent material. Through its effect on drainage, relief has helped to differentiate the two soils.

Time

Generally, a long time is required for the development of distinct horizons. Differences in the length of time that the parent material has been in place are commonly reflected in the degree of profile development. Some soils form rapidly. Others form slowly.

The soils in Barry 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 recent alluvial sediments in which the younger soils formed, however, have not been in place long enough for distinct horizons to develop.

Sloan soils, which formed in alluvial material, are an example of young soils. The mature Marlette soils are old enough for the formation of distinct horizons and for lime to have moved from the upper to the lower layers.

Processes of Soil Formation

Four major processes were involved in the development of horizons in the soils of Barry County. These are the accumulation of organic matter, the leaching of lime and other bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most of the soils in Barry County, more than one of these processes has been active.

As organic matter accumulates on the surface of a soil, the uppermost layer, or A horizon, is formed. If the soil is plowed, the A horizon is mixed into a plow layer, or Ap horizon. In the soils in Barry County, the organic matter content of the surface layer ranges from high to low. Sebewa soils, for example, have a high content and Spinks soils a low content of organic matter in the surface layer.

In most of the soils of Barry County, leaching of carbonates and other bases from the surface layer has occurred. This process generally precedes the translocation of silicate clay minerals. Several of the soils in Barry County are moderately to strongly leached. For example, Tekenink and Brems soils are leached of carbonates to a depth of more than 52 inches, whereas Marlette soils are leached to a depth of 34 inches. This difference in the depth of leaching is a result of differences in time, relief, and parent material.

Gleying, or the reduction and transfer of iron, is evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. A gray subsoil indicates the reduction and loss of iron. Sebewa soils are an example of strongly gleyed soils.

Translocation of clay minerals contributes to horizon development. The eluviated, or leached, E horizon typically 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 probably were leached of carbonates and soluble salts to a considerable extent before translocation of silicate clays occurred. Tekenink soils are an example of soils in which translocated silicate clay in the form of clay films has accumulated in the B horizon.

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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—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

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.

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.

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.

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.

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.

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.

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.

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.

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.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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.

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.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

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 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.

Parent material. The unconsolidated organic and mineral material in which soil forms.

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.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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.

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 degrees of acidity or alkalinity, expressed as pH values, are—

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.

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.

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 ir 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.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

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.

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 multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. Simple slopes in the survey are as follows:

Nearly level	0 to 2 percent
Nearly level or very gently sloping	0 to 4 percent
Nearly level to gently sloping	0 to 6 percent
Moderately sloping	6 to 12 percent
Strongly sloping	12 to 18 percent
Moderately steep or steep	18 to 40 percent

Complex slopes are as follows:

Nearly level	0 to 2 percent
Nearly level or gently undulating	0 to 4 percent
Nearly level to undulating	0 to 6 percent
Gently rolling	6 to 12 percent
Rolling	12 to 18 percent
Hilly or steep	18 to 40 percent

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, in millimeters, of separates recognized in the United States are as follows:

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.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing 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.

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.

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.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

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.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

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 a 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 Hastings, 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----	30.0	14.5	22.3	55	-15	0	1.72	0.8	2.5	4	14.8
February---	33.4	14.9	24.2	55	-14	0	1.38	.7	2.0	4	9.8
March------	43.6	24.1	33.9	74	-2	12	2.08	1.1	3.0	6	8.0
April------	58.7	35.6	47.2	83	15	94	3.21	2.3	4.1	7	2.6
May--------	70.9	45.6	58.3	89	26	291	2.74	1.4	3.9	6	.0
June-------	80.0	55.0	67.5	95	35	532	3.95	2.6	5.2	7	.0
July-------	83.8	58.7	71.2	95	43	666	2.81	1.7	3.8	6	.0
August-----	82.1	57.1	69.7	95	40	616	3.14	1.7	4.4	6	.0
September--	74.9	50.1	62.5	93	30	388	3.10	1.4	4.6	6	.0
October----	63.0	39.9	51.5	85	19	147	2.68	1.2	3.9	6	0.3
November---	47.4	30.8	39.1	72	8	22	2.34	1.4	3.2	7	5.4
December---	34.7	20.1	27.4	60	-8	0	2.08	0.9	3.1	5	11.2
Year-----	58.5	37.2	47.9	97	-18	2,768	31.23	26.0	36.3	70	52.1

* 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).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1930-79 at Hastings, 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--	Apr. 30	May 12	May 27
2 years in 10 later than--	Apr. 26	May 8	May 22
5 years in 10 later than--	Apr. 18	Apr. 29	May 13
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 9	Oct. 1	Sept. 18
2 years in 10 earlier than--	Oct. 13	Oct. 6	Sept. 22
5 years in 10 earlier than--	Oct. 30	Oct. 15	Sept. 30

TABLE 3.--GROWING SEASON

(Recorded in the period 1930-79 at Hastings, Michigan)

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	169	148	121
8 years in 10	178	155	128
5 years in 10	195	168	140
2 years in 10	212	181	152
1 year in 10	221	188	158

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
2	Adrian muck	2,695	0.7
5B	Ithaca loam, 0 to 4 percent slopes	3,065	0.8
6B	Boyer loamy sand, 0 to 6 percent slopes	3,406	0.9
6C	Boyer loamy sand, 6 to 12 percent slopes	2,573	0.7
6D	Boyer loamy sand, 12 to 18 percent slopes	1,572	0.4
6E	Boyer loamy sand, 18 to 40 percent slopes	1,975	0.5
7A	Brady sandy loam, 0 to 3 percent slopes	2,727	0.7
9B	Capac fine sandy loam, 0 to 4 percent slopes	12,608	3.4
13	Colwood loam	2,518	0.7
15	Edwards muck	845	0.2
16	Udorthents and Udipsamments, 0 to 6 percent slopes	1,622	0.4
18	Glendora loamy fine sand	1,548	0.4
19	Granby sand	1,926	0.5
20B	Tekenink fine sandy loam, 1 to 6 percent slopes	2,231	0.6
20C	Tekenink fine sandy loam, 6 to 12 percent slopes	4,806	1.3
20D	Tekenink fine sandy loam, 12 to 18 percent slopes	3,327	0.9
20E	Tekenink fine sandy loam, 18 to 40 percent slopes	2,574	0.7
21	Houghton muck	23,492	6.4
22A	Kalamazoo loam, 0 to 2 percent slopes	200	0.1
22B	Kalamazoo loam, 2 to 6 percent slopes	11,065	3.0
22C	Kalamazoo loam, 6 to 12 percent slopes	3,995	1.1
22D	Kalamazoo loam, 12 to 18 percent slopes	1,886	0.5
23	Lenawee silty clay loam	2,219	0.6
24B	Marlette loam, 2 to 6 percent slopes	7,051	1.9
24C	Marlette loam, 6 to 12 percent slopes	13,703	3.7
24D	Marlette loam, 12 to 18 percent slopes	7,274	2.0
24E	Marlette loam, 18 to 40 percent slopes	4,948	1.3
25	Histosols and Aquents, ponded	9,939	2.7
26B	Matherton loam, loamy substratum, 0 to 4 percent slopes	1,207	0.3
29C	Perrinton loam, 6 to 12 percent slopes	3,194	0.9
29D	Perrinton loam, 12 to 18 percent slopes	1,819	0.5
29E	Perrinton loam, 18 to 40 percent slopes	902	0.2
31B	Oshtemo sandy loam, 0 to 6 percent slopes	13,807	3.7
31C	Oshtemo sandy loam, 6 to 12 percent slopes	14,194	3.9
31D	Oshtemo sandy loam, 12 to 18 percent slopes	10,382	2.8
31E	Oshtemo sandy loam, 18 to 40 percent slopes	5,986	1.6
32	Palms muck	2,017	0.5
33	Parkhill loam	4,253	1.2
36	Sebewa loam, loamy substratum	612	0.2
37B	Selfridge loamy sand, 0 to 4 percent slopes	991	0.3
39	Sloan loam, sandy substratum	5,201	1.4
40B	Spinks loamy sand, 0 to 6 percent slopes	4,453	1.2
40C	Spinks loamy sand, 6 to 12 percent slopes	3,962	1.1
40D	Spinks loamy sand, 12 to 18 percent slopes	2,004	0.5
40E	Spinks loamy sand, 18 to 40 percent slopes	1,914	0.5
47B	Perrinton loam, moderately wet, 1 to 8 percent slopes	6,529	1.8
50B	Kibbie silt loam, 0 to 4 percent slopes	969	0.3
51A	Marlette fine sandy loam, moderately wet, 0 to 2 percent slopes	1,073	0.3
51B	Marlette fine sandy loam, moderately wet, 2 to 8 percent slopes	35,963	9.8
53	Pits	1,095	0.3
55	Algansee loamy fine sand	1,384	0.4
56A	Thetford loamy sand, 0 to 3 percent slopes	1,550	0.4
57B	Coloma loamy sand, 0 to 6 percent slopes	13,699	3.7
57C	Coloma loamy sand, 6 to 12 percent slopes	9,543	2.6
57D	Coloma loamy sand, 12 to 18 percent slopes	5,979	1.6
57E	Coloma loamy sand, 18 to 40 percent slopes	4,839	1.3
58B	Coloma-Boyer loamy sands, 0 to 6 percent slopes	7,769	2.1
58C	Coloma-Boyer loamy sands, 6 to 12 percent slopes	4,536	1.2
58D	Coloma-Boyer loamy sands, 12 to 18 percent slopes	4,338	1.2
58E	Coloma-Boyer loamy sands, 18 to 40 percent slopes	7,529	2.0
59A	Brems sand, 0 to 3 percent slopes	1,708	0.5
60A	Schoolcraft loam, 0 to 2 percent slopes	647	0.2
60B	Schoolcraft loam, 2 to 6 percent slopes	200	0.1
63B	Elston sandy loam, 0 to 6 percent slopes	356	0.1
67B	Marlette-Oshtemo complex, 0 to 6 percent slopes	4,283	1.2

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
67C	Marlette-Oshtemo complex, 6 to 12 percent slopes	8,743	2.4
67D	Marlette-Oshtemo complex, 12 to 18 percent slopes	6,979	1.9
67E	Marlette-Oshtemo complex, 18 to 40 percent slopes	5,816	1.6
68B	Coloma-Marlette complex, 0 to 6 percent slopes	581	0.2
68C	Coloma-Marlette complex, 6 to 12 percent slopes	1,112	0.3
68D	Coloma-Marlette complex, 12 to 18 percent slopes	802	0.2
68E	Coloma-Marlette complex, 18 to 40 percent slopes	2,639	0.7
	Water areas less than 40 acres in size	3,113	0.8
	Water areas more than 40 acres in size	10,750	2.9
	Total	369,212	100.0

TABLE 5.--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
5B	Ithaca loam, 0 to 4 percent slopes
7A	Brady sandy loam, 0 to 3 percent slopes
9B	Capac fine sandy loam, 0 to 4 percent slopes (where drained)
13	Colwood loam (where drained)
20B	Tekenink fine sandy loam, 1 to 6 percent slopes
22A	Kalamazoo loam, 0 to 2 percent slopes
22B	Kalamazoo loam, 2 to 6 percent slopes
23	Lenawee silty clay loam (where drained)
24B	Marlette loam, 2 to 6 percent slopes
26B	Matherton loam, loamy substratum, 0 to 4 percent slopes (where drained)
31B	Oshtemo sandy loam, 0 to 6 percent slopes
33	Parkhill loam (where drained)
36	Sebewa loam, loamy substratum (where drained)
37B	Selfridge loamy sand, 0 to 4 percent slopes
47B	Perrinton loam, moderately wet, 1 to 8 percent slopes
50B	Kibbie silt loam, 0 to 4 percent slopes (where drained)
51A	Marlette fine sandy loam, moderately wet, 0 to 2 percent slopes
60A	Schoolcraft loam, 0 to 2 percent slopes
60B	Schoolcraft loam, 2 to 6 percent slopes
63B	Elston sandy loam, 0 to 6 percent slopes
67B	Marlette-Oshtemo complex, 0 to 6 percent slopes

TABLE 6.--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	Corn silage	Soybeans	Alfalfa hay	Oats	Winter wheat
		Bu	Tons	Bu	Tons	Bu	Bu
2--------------- Adrian	Vw	---	---	---	---	---	---
5B-------------- Ithaca	IIe	105	16	38	4.0	85	46
6B-------------- Boyer	IIIs	90	14	30	4.0	70	45
6C-------------- Boyer	IIIe	90	14	30	4.0	70	45
6D-------------- Boyer	IVe	85	13	25	3.5	65	40
6E-------------- Boyer	VIIe	---	---	---	---	---	---
7A-------------- Brady	IIw	115	19	33	4.5	95	50
9B-------------- Capac	IIe	130	21	48	6.0	90	70
13-------------- Colwood	IIw	140	22	45	6.0	90	70
15-------------- Edwards	Vw	---	---	---	---	---	---
16. Udorthents and Udipsamments							
18-------------- Glendora	VIw	---	---	---	---	---	---
19-------------- Granby	Vw	---	---	---	---	---	---
20B------------- Tekenink	IIe	100	17	35	4.0	80	40
20C------------- Tekenink	IIIe	90	16	32	3.6	70	35
20D------------- Tekenink	IVe	80	15	30	3.2	55	32
20E------------- Tekenink	VIIe	---	---	---	---	---	---
21-------------- Houghton	Vw	---	---	---	---	---	---
22A------------- Kalamazoo	IIs	105	18	35	5.0	75	55

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Soybeans	Alfalfa hay	Oats	Winter wheat
		Bu	Tons	Bu	Tons	Bu	Bu
22B------------- Kalamazoo	IIe	105	18	35	5.0	75	55
22C------------- Kalamazoo	IIIe	100	17	30	4.5	75	50
22D------------- Kalamazoo	IVe	90	16	24	4.5	65	48
23-------------- Lenawee	IIw	130	20	42	6.0	100	60
24B------------- Marlette	IIe	125	20	45	6.0	90	70
24C------------- Marlette	IIIe	120	19	42	6.0	85	65
24D------------- Marlette	IVe	110	16	35	5.0	75	60
24E------------- Marlette	VIIe	---	---	---	---	---	---
25. Histosols and Aquents							
26B------------- Matherton	IIw	100	17	---	---	70	---
29C------------- Perrinton	IIIe	100	16	30	4.5	70	45
29D------------- Perrinton	IVe	85	12	24	4.0	70	45
29E------------- Perrinton	VIIe	---	---	---	---	---	---
31B------------- Oshtemo	IIIs	95	15	33	4.5	75	50
31C------------- Oshtemo	IIIe	95	15	33	4.5	75	50
31D------------- Oshtemo	IVe	90	13	28	4.0	70	45
31E------------- Oshtemo	VIIe	---	---	---	---	---	---
32-------------- Palms	Vw	---	---	---	---	---	---
33-------------- Parkhill	IIw	140	24	50	6.0	90	70
36-------------- Sebewa	IIw	115	19	---	4.8	95	---
37B------------- Selfridge	IIIe	110	18	34	4.2	75	38

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Soybeans	Alfalfa hay	Oats	Winter wheat
		Bu	Tons	Bu	Tons	Bu	Bu
39-------------- Sloan	Vw	---	---	---	---	---	---
40B------------- Spinks	IIIs	80	13	25	3.5	60	40
40C------------- Spinks	IIIe	80	13	25	3.5	60	40
40D------------- Spinks	IVe	75	12	24	3.0	55	35
40E------------- Spinks	VIIe	---	---	---	---	---	---
47B------------- Perrinton	IIe	100	15	30	4.0	70	45
50B------------- Kibbie	IIe	125	20	38	5.0	100	60
51A------------- Marlette	I	125	20	45	6.0	90	70
51B------------- Marlette	IIe	125	20	45	6.0	90	70
53*. Pits							
55-------------- Algansee	IIIw	85	14	---	3.8	65	35
56A------------- Thetford	IIIw	85	14	32	3.8	65	35
57B------------- Coloma	IVs	65	7	18	---	45	---
57C------------- Coloma	VIs	---	---	---	---	---	---
57D------------- Coloma	VIs	---	---	---	---	---	---
57E------------- Coloma	VIIs	---	---	---	---	---	---
58B------------- Coloma-Boyer	IVs	80	13	25	3.5	60	40
58C------------- Coloma-Boyer	VIs	---	---	---	---	---	---
58D------------- Coloma-Boyer	VIs	---	---	---	---	---	---
58E------------- Coloma-Boyer	VIIs	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Soybeans	Alfalfa hay	Oats	Winter wheat
		Bu	Tons	Bu	Tons	Bu	Bu
59A------------- Brems	IVs	70	16	24	---	45	32
60A------------- Schoolcraft	IIs	120	19	35	4.8	95	60
60B------------- Schoolcraft	IIe	120	18	32	4.6	95	60
63B------------- Elston	IIe	90	18	32	4.0	---	40
67B------------- Marlette-Oshtemo	IIe	105	18	35	5.0	80	55
67C------------- Marlette-Oshtemo	IIIe	100	17	30	4.5	75	50
67D------------- Marlette-Oshtemo	IVe	90	15	24	4.5	65	48
67E------------- Marlette-Oshtemo	VIIe	---	---	---	---	---	---
68B------------- Coloma-Marlette	IVs	80	14	25	3.5	60	30
68C------------- Coloma-Marlette	VIs	---	---	---	---	---	---
68D------------- Coloma-Marlette	VIs	---	---	---	---	---	---
68E------------- Coloma-Marlette	VIIs	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--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	1,073	---	---	---
II	98,703	84,320	13,536	847
III	80,761	56,161	2,934	21,666
IV	59,000	35,243	---	23,757
V	36,174	---	36,174	---
VI	27,858	---	1,548	26,310
VII	39,122	24,115	---	15,007
VIII	---	---	---	---

TABLE 8.--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	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
2-------------- Adrian	2W	Slight	Severe	Severe	Severe	Silver maple--------	78	32	
						Red maple-----------	53	39	
						White ash-----------	69	64	
						Quaking aspen-------	60	64	
						Tamarack------------	45	35	
						Green ash-----------	69	64	
5B-------------- Ithaca	4W	Slight	Severe	Slight	Slight	Northern red oak----	65	59	White spruce, northern whitecedar, eastern white pine.
						Sugar maple---------	---	---	
						American basswood---	---	---	
						White ash-----------	---	---	
						Northern pin oak----	---	---	
						Shagbark hickory----	---	---	
						Red maple-----------	---	---	
						Bitternut hickory---	---	---	
6B, 6C, 6D------ Boyer	4A	Slight	Slight	Slight	Slight	Northern red oak----	66	60	Eastern white pine, red pine, white oak, northern red oak.
						White oak-----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
						Black oak-----------	---	---	
6E-------------- Boyer	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	66	60	Eastern white pine, red pine, white oak, northern red oak.
						White oak-----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
						Black oak-----------	---	---	
7A-------------- Brady	3W	Slight	Moderate	Slight	Slight	Red maple-----------	61	38	Eastern white pine, white spruce.
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Silver maple--------	---	---	
						Bitternut hickory---	---	---	
						Swamp white oak-----	---	---	
						American basswood---	61	53	
9B-------------- Capac	4W	Slight	Moderate	Slight	Slight	Northern red oak----	65	59	Eastern white pine, white spruce, black walnut, white ash.
						American basswood---	---	---	
						Northern pin oak----	---	---	
						White ash-----------	---	---	
						Red maple-----------	---	---	
						Bitternut hickory---	---	---	
						Sugar maple---------	---	---	
						Black cherry--------	---	---	
						American beech------	---	---	
13-------------- Colwood	2W	Slight	Severe	Severe	Severe	Silver maple--------	82	36	
						Red maple-----------	56	36	
						White ash-----------	56	44	
						Green ash-----------	---	---	
						Swamp white oak-----	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
15-------------- Edwards	2W	Slight	Severe	Severe	Severe	Red maple-----------	56	36	
						White ash-----------	---	---	
						Green ash-----------	---	---	
						Tamarack------------	---	---	
						Swamp white oak-----	---	---	
						Silver maple--------	---	---	
18-------------- Glendora	3W	Slight	Severe	Moderate	Moderate	Silver maple--------	90	42	
						Red maple-----------	65	40	
						Swamp white oak-----	---	---	
						Quaking aspen-------	---	---	
						Black ash-----------	---	---	
						Eastern cottonwood--	---	---	
						White ash-----------	65	59	
19-------------- Granby	2W	Slight	Severe	Severe	Severe	Silver maple--------	82	36	
						Red maple-----------	68	42	
						American basswood---	---	---	
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern cottonwood--	---	---	
20B, 20C, 20D--- Tekenink	4A	Slight	Slight	Slight	Slight	Northern red oak----	66	60	Black walnut, red pine, eastern white pine, yellow poplar, black cherry, red oak, white ash.
						Black cherry--------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						American beech------	---	---	
						Sugar maple---------	---	---	
20E------------- Tekenink	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	66	60	Black walnut, red pine, eastern white pine, yellow poplar, black cherry, red oak, white ash.
						Black cherry--------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						American beech------	---	---	
						Sugar maple---------	---	---	
21-------------- Houghton	2W	Slight	Severe	Severe	Severe	Silver maple--------	82	36	
						Red maple-----------	56	36	
						White ash-----------	56	44	
						Quaking aspen-------	60	64	
						Tamarack------------	52	45	
						Green ash-----------	---	---	
						Northern whitecedar-	37	55	
22A, 22B, 22C, 22D------------ Kalamazoo	4A	Slight	Slight	Slight	Slight	Northern red oak----	65	59	Black walnut, northern red oak, yellow poplar, eastern white pine, white spruce, red pine, black cherry.
						White ash-----------	65	59	
						Black walnut--------	65	---	
						Yellow poplar-------	65	45	
						White oak-----------	---	---	
						Black cherry--------	---	---	
						American basswood---	65	59	
						Sugar maple---------	61	38	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Common trees	Site index	Volume*	
23-------------- Lenawee	2W	Slight	Severe	Severe	Severe	Red maple-----------	55	35	
						White ash-----------	---	---	
						American basswood---	---	---	
						Silver maple--------	---	---	
24B, 24C, 24D--- Marlette	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	Black walnut, eastern white pine, yellow poplar, white spruce, northern red oak, black cherry.
						Northern red oak----	69	64	
						White ash-----------	---	---	
						Black walnut--------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
						White oak-----------	---	---	
24E------------- Marlette	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	65	40	Black walnut, eastern white pine, yellow poplar, white spruce, northern red oak, black cherry.
						Northern red oak----	69	64	
						White ash-----------	---	---	
						Black walnut--------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
						White oak-----------	---	---	
26B------------- Matherton	4W	Slight	Severe	Slight	Slight	Northern red oak----	61	53	Eastern white pine, white spruce, white ash.
						Swamp white oak-----	---	---	
						White oak-----------	---	---	
						White ash-----------	---	---	
						Bitternut hickory---	---	---	
29C, 29D-------- Perrinton	4A	Slight	Slight	Slight	Slight	Northern red oak----	65	59	White spruce, eastern white pine, northern whitecedar, black walnut, northern red oak.
						Sugar maple---------	---	---	
						Red maple-----------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						Bitternut hickory---	---	---	
						Shagbark hickory----	---	---	
29E------------- Perrinton	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	65	59	White spruce, eastern white pine, northern whitecedar, black walnut, northern red oak.
						Sugar maple---------	---	---	
						Red maple-----------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
						Bitternut hickory---	---	---	
						Shagbark hickory----	---	---	
31B, 31C, 31D--- Oshtemo	4A	Slight	Slight	Slight	Slight	Northern red oak----	66	60	Eastern white pine, red pine, white spruce, black cherry, black walnut, yellow poplar.
						White oak-----------	---	---	
						American basswood---	66	60	
						Sugar maple---------	61	38	
31E------------- Oshtemo	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	66	60	Eastern white pine, red pine, white spruce, black cherry, black walnut, yellow poplar.
						White oak-----------	---	---	
						American basswood---	66	60	
						Sugar maple---------	61	38	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination 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
32 Palms	2W	Slight	Severe	Severe	Severe	Red maple	55	35	
						Silver maple	80	34	
						White ash	---	---	
						Quaking aspen	---	---	
						Northern whitecedar	---	---	
						Tamarack	---	---	
						Black ash	---	---	
33 Parkhill	3W	Slight	Severe	Severe	Severe	Red maple	66	41	
						Silver maple	91	43	
						Pin oak	---	---	
						White ash	66	60	
						American basswood	66	60	
						Swamp white oak	---	---	
36 Sebewa	2W	Slight	Severe	Severe	Severe	Silver maple	70	25	White spruce, white ash, eastern white pine.
						White ash	---	---	
						Red maple	---	---	
						Swamp white oak	---	---	
						American basswood	---	---	
						Shagbark hickory	---	---	
37B Selfridge	6W	Slight	Moderate	Slight	Slight	Quaking aspen	70	81	Eastern white pine, white spruce, white ash.
						American beech	---	---	
						Northern red oak	---	---	
						Red maple	---	---	
						Sugar maple	---	---	
						Black cherry	---	---	
						American basswood	---	---	
39 Sloan	3W	Slight	Severe	Moderate	Moderate	Red maple	66	41	
						Eastern cottonwood	89	100	
						White ash	66	60	
						Green ash	66	60	
						Swamp white oak	---	---	
						Pin oak	---	---	
40B, 40C, 40D Spinks	4A	Slight	Slight	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, northern red oak.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
40E Spinks	4R	Moderate	Moderate	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine, northern red oak.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
47B Perrinton	4A	Slight	Slight	Slight	Slight	Northern red oak	65	59	Eastern white pine, northern whitecedar, white spruce, black walnut, northern red oak.
						Sugar maple	---	---	
						Red maple	---	---	
						White ash	---	---	
						American basswood	---	---	
						Bitternut hickory	---	---	
						Shagbark hickory	---	---	
50B Kibbie	4W	Slight	Severe	Slight	Slight	Northern red oak	66	60	Eastern white pine, white spruce, white ash, yellow poplar.
						Red maple	---	---	
						White ash	---	---	
						American basswood	---	---	
						Quaking aspen	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination 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
51A, 51B-------- Marlette	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	Black walnut, eastern white pine, northern red oak, yellow poplar, black cherry, white ash.
						Northern red oak----	69	64	
						White ash-----------	---	---	
						Black walnut--------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
						White oak-----------	---	---	
55-------------- Algansee	4W	Slight	Severe	Slight	Slight	Quaking aspen-------	60	64	White spruce, eastern white pine, black walnut, white ash.
						Silver maple--------	78	32	
						Swamp white oak-----	---	---	
						White ash-----------	---	---	
						Red maple-----------	56	32	
						American sycamore---	---	---	
						Green ash-----------	---	---	
56A------------- Thetford	3W	Slight	Moderate	Slight	Slight	Red maple-----------	65	40	White spruce, eastern white pine.
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern cottonwood--	---	---	
						Northern red oak----	---	---	
						Swamp white oak-----	---	---	
						Bitternut hickory---	---	---	
57B, 57C, 57D--- Coloma	2A	Slight	Moderate	Moderate	Slight	Northern pin oak----	49	32	Red pine, eastern white pine, northern red oak.
						Jack pine-----------	---	---	
						Black oak-----------	---	---	
						White oak-----------	---	---	
						Eastern white pine--	---	---	
57E------------- Coloma	2R	Moderate	Moderate	Moderate	Slight	Northern pin oak----	49	32	Red pine, eastern white pine, northern red oak.
						Jack pine-----------	---	---	
						Black oak-----------	---	---	
						White oak-----------	---	---	
						Eastern white pine--	---	---	
58B**, 58C**: 58D**:									
Coloma--------	2A	Slight	Moderate	Moderate	Slight	Northern pin oak----	49	32	Red pine, eastern white pine, northern red oak.
						Jack pine-----------	---	---	
						Black oak-----------	---	---	
						White oak-----------	---	---	
						Eastern white pine--	---	---	
Boyer---------	4A	Slight	Slight	Slight	Slight	Northern red oak----	66	60	Eastern white pine, red pine, northern red oak, white oak, white spruce.
						White oak-----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
						Black oak-----------	---	---	
58E**:									
Coloma---------	2R	Moderate	Moderate	Moderate	Slight	Northern pin oak----	49	32	Red pine, eastern white pine, northern red oak.
						Jack pine-----------	---	---	
						Black oak-----------	---	---	
						White oak-----------	---	---	
						Eastern white pine--	---	---	

See footnotes at end of table.

TABLE 8.--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*	
58E**:									
Boyer	4R	Moderate	Moderate	Slight	Slight	Northern red oak White oak American basswood Sugar maple Black oak	66 --- --- --- ---	60 --- --- --- ---	Eastern white pine, red pine, Norway spruce, northern red oak, white oak.
59A Brems	3S	Slight	Moderate	Moderate	Slight	Pin oak Black oak White oak Jack pine	59 --- --- 55	48 --- --- 77	Eastern white pine, red pine, northern red oak.
67B**, 67C**, 67D**:									
Marlette	3A	Slight	Slight	Slight	Slight	Sugar maple Northern red oak White ash Black walnut American basswood Black cherry White oak	65 69 --- --- --- --- ---	40 64 --- --- --- --- ---	Black walnut, eastern white pine, yellow poplar, white spruce, northern red oak, black cherry.
Oshtemo	4A	Slight	Slight	Slight	Slight	Northern red oak White oak American basswood Sugar maple	66 --- 66 61	60 --- 60 38	Eastern white pine, red pine, white spruce, black walnut, black cherry, yellow poplar.
67E**:									
Marlette	3R	Moderate	Moderate	Slight	Slight	Sugar maple Northern red oak White ash Black walnut American basswood Black cherry White oak	65 69 --- --- --- --- ---	40 64 --- --- --- --- ---	Black walnut, eastern white pine, yellow poplar, white spruce, northern red oak, black cherry.
Oshtemo	4R	Moderate	Moderate	Slight	Slight	Northern red oak White oak American basswood Sugar maple	66 --- 66 61	60 --- 60 38	Eastern white pine, red pine, white spruce, black walnut, black cherry, yellow poplar.
68B**, 68C**, 68D**:									
Coloma	2A	Slight	Moderate	Moderate	Slight	Northern pin oak Jack pine Black oak White oak Fastern white pine	49 --- --- --- ---	32 --- --- --- ---	Red pine, eastern white pine, northern red oak.

See footnotes at end of table.

TABLE 8.--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*	
68B**, 68C**, 68D**:									
Marlette	3A	Slight	Slight	Slight	Slight	Sugar maple	65	40	Black walnut, eastern white pine, yellow poplar, white spruce, black cherry, northern red oak.
						Northern red oak	69	64	
						White ash	---	---	
						Black walnut	---	---	
						American basswood	---	---	
						Black cherry	---	---	
						White oak	---	---	
68E**:									
Coloma	2R	Moderate	Moderate	Moderate	Slight	Northern pin oak	49	32	Red pine, eastern white pine, northern red oak.
						Jack pine	---	---	
						Black oak	---	---	
						White oak	---	---	
						Eastern white pine	---	---	
Marlette	3R	Moderate	Moderate	Slight	Slight	Sugar maple	65	40	Black walnut, eastern white pine, yellow poplar, white spruce, black cherry, northern red oak.
						Northern red oak	69	64	
						White ash	---	---	
						Black walnut	---	---	
						American basswood	---	---	
						Black cherry	---	---	
						White oak	---	---	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--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--			
	8-15	16-25	26-35	>35
2 Adrian	Silky dogwood, common ninebark, Amur privet, American cranberrybush, late lilac, Japanese tree lilac, nannyberry viburnum.	Northern whitecedar	Eastern white pine, Siberian crabapple, green ash.	Imperial Carolina poplar.
5B Ithaca	Silky dogwood, Amur maple, lilac, American cranberrybush, Amur privet.	Northern whitecedar, white spruce, Siberian crabapple.	Eastern white pine, green ash, Norway spruce, red maple.	---
6B, 6C, 6D, 6E Boyer	Siberian peashrub, nannyberry viburnum, lilac, Roselow sargent crabapple, eastern redcedar.	---	Eastern white pine, red pine, Norway spruce, white spruce, jack pine, green ash.	Imperial Carolina poplar.
7A Brady	Silky dogwood, lilac, nannyberry viburnum, Amur maple, American cranberrybush.	Northern whitecedar	White spruce, Norway spruce, eastern white pine, red pine, green ash.	Imperial Carolina poplar.
9B Capac	Silky dogwood, American cranberrybush, Amur privet, Amur maple, lilac.	Northern whitecedar	Eastern white pine, white spruce, red maple, Norway spruce, green ash.	Imperial Carolina poplar.
13 Colwood	Silky dogwood, American cranberrybush, Amur privet, nannyberry viburnum, lilac.	Manchurian crabapple, northern whitecedar.	White spruce, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
15 Edwards	Amur privet, nannyberry viburnum, American cranberrybush, silky dogwood, common ninebark, Amur maple.	Manchurian crabapple, northern whitecedar, imperial Carolina poplar.	White spruce, green ash, black willow.	---
16*:				
Udorthents.				
Udipsamments.				
18 Glendora	Nannyberry viburnum, common ninebark, American cranberrybush, lilac.	Northern whitecedar, Siberian crabapple.	White spruce, eastern white pine, Norway spruce, green ash, red maple.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
19---------------- Granby	American cranberrybush, lilac, silky dogwood, nannyberry viburnum, Amur privet.	Northern whitecedar, Manchurian crabapple, white spruce.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
20B, 20C, 20D, 20E-------------- Tekenink	Amur privet, nannyberry viburnum, lilac, silky dogwood, American cranberrybush.	White spruce, northern whitecedar.	Eastern white pine, red pine, Norway spruce, green ash.	Imperial Carolina poplar.
21---------------- Houghton	Silky dogwood, late lilac, Amur privet, common ninebark, nannyberry viburnum.	Japanese tree lilac, northern whitecedar.	Black willow, green ash, Siberian crabapple, eastern white pine.	Imperial Carolina poplar.
22A, 22B, 22C, 22D-------------- Kalamazoo	Lilac, American cranberrybush, Siberian peashrub, silky dogwood, nannyberry viburnum, eastern redcedar.	Red pine, jack pine, green ash.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
23---------------- Lenawee	Silky dogwood, Amur privet, common ninebark, nannyberry viburnum, American cranberrybush.	Northern whitecedar, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce, white spruce, red maple.	---
24B, 24C, 24D, 24E-------------- Marlette	American cranberrybush, common ninebark, lilac, silky dogwood.	Amur maple, Manchurian crabapple, nannyberry viburnum.	White spruce, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
25*:				
Histosols.				
Aquents.				
26B--------------- Matherton	American cranberrybush, nannyberry viburnum, Amur maple, lilac, silky dogwood.	Northern whitecedar, Siberian crabapple.	Eastern white pine, Norway spruce, green ash, red maple, white spruce.	---
29C, 29D, 29E----- Perrinton	Amur maple, Roselow sargent crabapple, lilac, silky dogwood, American cranberrybush.	Northern whitecedar, Manchurian crabapple, nannyberry viburnum.	Eastern white pine, green ash, white spruce, Norway spruce.	---
31B, 31C, 31D, 31E-------------- Oshtemo	Eastern redcedar, lilac, Siberian peashrub, silky dogwood, American cranberrybush, nannyberry viburnum.	Jack pine, green ash	Eastern white pine, red pine, Norway spruce.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
32 Palms	Silky dogwood, common ninebark, nannyberry viburnum, American cranberrybush.	Northern whitecedar, Manchurian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
33 Parkhill	Silky dogwood, common ninebark, Amur privet, lilac, nannyberry viburnum, American cranberrybush.	Northern whitecedar, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce, white spruce.	---
36 Sebewa	Redosier dogwood, nannyberry viburnum, American plum, American cranberrybush.	Amur maple, northern whitecedar, white spruce.	Eastern white pine, green ash, red maple.	Silver maple, eastern cottonwood.
37B Selfridge	Silky dogwood, lilac, Amur maple, American cranberrybush, nannyberry viburnum.	Northern whitecedar, Siberian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash, red maple.	---
39 Sloan	Amur privet, arrowwood, whitebelle honeysuckle, autumn olive, American cranberrybush.	Green ash, northern whitecedar, eastern white pine.	---	Imperial Carolina poplar.
40B, 40C, 40D, 40E Spinks	American cranberrybush, silky dogwood, eastern redcedar, lilac, Siberian peashrub.	Red pine, white spruce, jack pine.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
47B Perrinton	Common ninebark, lilac, silky dogwood, Amur privet, American cranberrybush, nannyberry viburnum.	Northern whitecedar, Siberian crabapple.	Eastern white pine, green ash, Norway spruce, white spruce.	---
50B Kibbie	Common ninebark, silky dogwood, lilac, nannyberry viburnum, American cranberrybush, Amur privet.	Northern whitecedar, white spruce, Siberian crabapple.	Eastern white pine, green ash, Norway spruce.	---
51A, 51B Marlette	American cranberrybush, lilac, silky dogwood, nannyberry viburnum.	Northern whitecedar, Amur maple, Manchurian crabapple.	White spruce, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
53*. Pits				
55 Algansee	Silky dogwood, Amur privet, Amur maple, lilac, American cranberrybush.	Northern whitecedar	Green ash, eastern white pine, Norway spruce, red maple, white spruce.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
56A: Thetford	Silky dogwood, lilac, Amur maple, American cranberrybush, Amur privet.	White spruce, northern whitecedar.	Norway spruce, eastern white pine, red maple, green ash.	Imperial Carolina poplar.
57B, 57C, 57D, 57E: Coloma	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce	Eastern white pine, red pine, jack pine.	---
58B*, 58C*, 58D*, 58E*:				
Coloma	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Boyer	Siberian peashrub, nannyberry viburnum, lilac, Roselow sargent crabapple, eastern redcedar.	---	Eastern white pine, red pine, Norway spruce, white spruce, jack pine, green ash.	Imperial Carolina poplar.
59A: Brems	Eastern redcedar, Amur maple, Siberian peashrub, gray dogwood.	Red pine, Norway spruce, lilac.	Eastern white pine, jack pine, Siberian crabapple, green ash.	---
60A, 60B: Schoolcraft	Lilac, Amur privet, sargent crabapple, northern whitecedar, American cranberrybush, nannyberry viburnum, silky dogwood.	---	Red pine, white spruce, Norway spruce, green ash, eastern white pine.	---
63B: Elston	Lilac, Amur privet, autumn olive, Siberian peashrub.	Eastern redcedar, Manchurian crabapple.	Eastern white pine, Norway spruce, red pine, Austrian pine.	Imperial Carolina poplar.
67B*, 67C*, 67D*, 67E*:				
Marlette	American cranberrybush, common ninebark, lilac, silky dogwood.	Amur maple, Manchurian crabapple, nannyberry viburnum.	White spruce, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
Oshtemo	Eastern redcedar, lilac, Siberian peashrub, silky dogwood, American cranberrybush, nannyberry viburnum.	Jack pine, green ash	Eastern white pine, red pine, Norway spruce.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
68B*, 68C*, 68D*, 68E*:				
Coloma	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Marlette	American cranberrybush, common ninebark, lilac, silky dogwood.	Amur maple, Manchurian crabapple, nannyberry viburnum.	White spruce, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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
2 Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
5B Ithaca	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
6B Boyer	Slight	Slight	Moderate: slope, small stones.	Slight.
6C Boyer	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
6D Boyer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
6E Boyer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
7A Brady	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
9B Capac	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
13 Colwood	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
15 Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
16*: Udorthents.				
Udipsamments.				
18 Glendora	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
19 Granby	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.
20B Tekenink	Slight	Slight	Moderate: slope, small stones.	Slight.
20C Tekenink	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
20D Tekenink	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
20E Tekenink	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
21 Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
22A, 22B Kalamazoo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
22C Kalamazoo	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
22D Kalamazoo	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
23 Lenawee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
24B Marlette	Slight	Slight	Moderate: slope, small stones.	Slight.
24C Marlette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
24D Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
24E Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
25*:				
Histosols.				
Aquents.				
26B Matherton	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
29C Perrinton	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
29D Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
29E Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
31B Oshtemo	Slight	Slight	Moderate: slope, small stones.	Slight.
31C Oshtemo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
31D: Oshtemo	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
31E: Oshtemo	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
32: Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
33: Parkhill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
36: Sebewa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
37B: Selfridge	Severe: wetness.	Moderate: wetness, too sandy, percs slowly.	Severe: wetness.	Moderate: wetness, too sandy.
39: Sloan	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
40B: Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
40C: Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
40D: Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.
40E: Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
47B: Perrinton	Slight	Slight	Moderate: slope, small stones.	Slight.
50B: Kibbie	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
51A: Marlette	Slight	Slight	Moderate: small stones.	Slight.
51B: Marlette	Slight	Slight	Moderate: slope, small stones.	Slight.
53*. Pits				
55: Algansee	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
56A Thetford	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
57B Coloma	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
57C Coloma	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
57D Coloma	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
57E Coloma	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
58B*:				
Coloma	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
Boyer	Slight	Slight	Moderate: slope, small stones.	Slight.
58C*:				
Coloma	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Boyer	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
58D*:				
Coloma	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Boyer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
58E*:				
Coloma	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Boyer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
59A Brems	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
60A Schoolcraft	Slight	Slight	Slight	Slight.
60B Schoolcraft	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
63B Elston	Slight	Slight	Moderate: slope.	Slight.
67B*:				
Marlette	Slight	Slight	Moderate: slope, small stones.	Slight.
Oshtemo	Slight	Slight	Moderate: slope, small stones.	Slight.
67C*:				
Marlette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Oshtemo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
67D*:				
Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Oshtemo	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
67E*:				
Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Oshtemo	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
68B*:				
Coloma	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
Marlette	Slight	Slight	Moderate: slope, small stones.	Slight.
68C*:				
Coloma	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Marlette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
68D*:				
Coloma	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
68E*:				
Coloma	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--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							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
2 Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
5B Ithaca	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
6B, 6C, 6D Boyer	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
6E Boyer	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
7A Brady	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
9B Capac	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor.
13 Colwood	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
15 Edwards	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
16*: Udorthents.										
Udipsamments.										
18 Glendora	Very poor.	Very poor.	Fair	Fair	Fair	Good	Good	Very poor.	Fair	Good.
19 Granby	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
20B Tekenink	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
20C Tekenink	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
20D Tekenink	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
20E Tekenink	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
21 Houghton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
22A, 22B Kalamazoo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
22C, 22D Kalamazoo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--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
23 Lenawee	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
24B Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
24C Marlette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
24D Marlette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
24E Marlette	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
25*: Histosols.										
Aquents.										
26B Matherton	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
29C Perrinton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
29D Perrinton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
29E Perrinton	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
31B Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
31C Oshtemo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
31D Oshtemo	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
31E Oshtemo	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
32 Palms	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
33 Parkhill	Poor	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
36 Sebewa	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
37B Selfridge	Fair	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
39 Sloan	Fair	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.

See footnote at end of table.

TABLE 11.--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
40B Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
40C, 40D Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
40E Spinks	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
47B Perrinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
50B Kibbie	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Fair.
51A, 51B Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
53*. Pits										
55 Algansee	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
56A Thetford	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
57B Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
57C, 57D Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
57E Coloma	Very poor.	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
58B*: Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Boyer	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
58C*, 58D*: Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Boyer	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
58E*: Coloma	Very poor.	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Boyer	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
59A Brems	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor.

See footnote at end of table.

TABLE 11.--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
60A, 60B Schoolcraft	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
63B Elston	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
67B*:										
Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
67C*:										
Marlette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Oshtemo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
67D*:										
Marlette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Oshtemo	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
67E*:										
Marlette	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Oshtemo	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
68B*:										
Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
68C*:										
Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Marlette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
68D*:										
Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Marlette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
68E*:										
Coloma	Very poor.	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Marlette	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--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
2----------------- Adrian	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
5B---------------- Ithaca	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
6B---------------- Boyer	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
6C---------------- Boyer	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
6D, 6E------------ Boyer	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
7A---------------- Brady	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
9B---------------- Capac	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
13---------------- Colwood	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
15---------------- Edwards	Severe: ponding, excess humus.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: excess humus, ponding.
16*:						
Udorthents.						
Udipsamments.						
18---------------- Glendora	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
19---------------- Granby	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
20B--------------- Tekenink	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: large stones, droughty.

See footnote at end of table.

TABLE 12.--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
20C---------------- Tekenink	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.
20D, 20E---------- Tekenink	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
21----------------- Houghton	Severe: ponding, excess humus.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: excess humus, ponding.
22A---------------- Kalamazoo	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Moderate: small stones.
22B---------------- Kalamazoo	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Moderate: small stones.
22C---------------- Kalamazoo	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: small stones, slope.
22D---------------- Kalamazoo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
23----------------- Lenawee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
24B---------------- Marlette	Slight----------	Slight----------	Slight----------	Moderate: slope.	Severe: low strength.	Slight.
24C---------------- Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
24D, 24E---------- Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
25*: Histosols.						
Aquents.						
26B---------------- Matherton	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
29C---------------- Perrinton	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.

See footnote at end of table.

TABLE 12.--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
29D, 29E---------- Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
31B--------------- Oshtemo	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
31C--------------- Oshtemo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
31D, 31E---------- Oshtemo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
32---------------- Palms	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
33---------------- Parkhill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
36---------------- Sebewa	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
37B--------------- Selfridge	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
39---------------- Sloan	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
40B--------------- Spinks	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
40C--------------- Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
40D, 40E---------- Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
47B--------------- Perrinton	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
50B--------------- Kibbie	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
51A--------------- Marlette	Moderate: wetness.	Slight---------	Moderate: wetness.	Slight---------	Severe: low strength.	Slight.
51B--------------- Marlette	Moderate: wetness.	Slight---------	Moderate: wetness.	Moderate: slope.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 12.--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
53*. Pits						
55 Algansee	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Moderate: flooding, wetness.
56A Thetford	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
57B Coloma	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: large stones, droughty.
57C Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
57D, 57E Coloma	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
58B*:						
Coloma	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: large stones, droughty.
Boyer	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
58C*:						
Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
Boyer	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
58D*, 58E*:						
Coloma	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Boyer	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
59A Brems	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
60A Schoolcraft	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.

See footnote at end of table.

TABLE 12.--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
60B: Schoolcraft	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
63B: Elston	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
67B*:						
Marlette	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
Oshtemo	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
67C*:						
Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Oshtemo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
67D*, 67E*:						
Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Oshtemo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
68B*:						
Coloma	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: large stones, droughty.
Marlette	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
68C*:						
Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
68D*, 68E*:						
Coloma	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "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	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2------------------- Adrian	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
5B------------------ Ithaca	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
6B------------------ Boyer	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
6C------------------ Boyer	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
6D, 6E-------------- Boyer	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
7A------------------ Brady	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
9B------------------ Capac	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
13------------------ Colwood	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding, thin layer.
15------------------ Edwards	Severe: subsides, ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.
16*: Udorthents.					
Udipsamments.					
18------------------ Glendora	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.

See footnote at end of table.

TABLE 13.--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
19 Granby	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
20B Tekenink	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: small stones.
20C Tekenink	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Fair: small stones, slope.
20D, 20E Tekenink	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
21 Houghton	Severe: subsides, ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
22A, 22B Kalamazoo	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
22C Kalamazoo	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
22D Kalamazoo	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope, thin layer.
23 Lenawee	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
24B Marlette	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
24C Marlette	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
24D, 24E Marlette	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
25*: Histosols.					
Aquents.					
26B Matherton	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness, thin layer.
29C Perrinton	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 13.--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
29D, 29E Perrinton	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
31B Oshtemo	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
31C Oshtemo	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
31D, 31E Oshtemo	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
32 Palms	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding.
33 Parkhill	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
36 Sebewa	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding, too clayey.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.
37B Selfridge	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
39 Sloan	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
40B Spinks	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
40C Spinks	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
40D, 40E Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
47B Perrinton	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
50B Kibbie	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.

See footnote at end of table.

TABLE 13.--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
51A, 51B----------- Marlette	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
53*. Pits					
55----------------- Algansee	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
56A---------------- Thetford	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.
57B---------------- Coloma	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
57C---------------- Coloma	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
57D, 57E----------- Coloma	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
58B*:					
Coloma-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Boyer--------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
58C*:					
Coloma-------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Boyer--------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
58D*, 58E*:					
Coloma-------------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Boyer--------------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 13.--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
59A------------------ Brems	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
60A, 60B------------ Schoolcraft	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
63B------------------ Elston	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
67B*:					
Marlette-----------	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
Oshtemo------------	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
67C*:					
Marlette-----------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Oshtemo------------	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
67D*, 67E*:					
Marlette-----------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Oshtemo------------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
68B*:					
Coloma-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Marlette-----------	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
68C*:					
Coloma-------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Marlette-----------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
68D*, 68E*:					
Coloma-------------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Marlette-----------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--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
2----------- Adrian	Poor: wetness.	Probable-----------	Improbable: too sandy.	Poor: excess humus, wetness.
5B----------- Ithaca	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
6B, 6C----------- Boyer	Good-----------	Probable-----------	Probable-----------	Poor: small stones, area reclaim.
6D----------- Boyer	Fair: slope.	Probable-----------	Probable-----------	Poor: small stones, area reclaim, slope.
6E----------- Boyer	Poor: slope.	Probable-----------	Probable-----------	Poor: small stones, area reclaim, slope.
7A----------- Brady	Fair: wetness.	Probable-----------	Probable-----------	Poor: small stones.
9B----------- Capac	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, area reclaim.
13----------- Colwood	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
15----------- Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
16*: Udorthents.				
Udipsamments.				
18----------- Glendora	Poor: wetness.	Probable-----------	Improbable: too sandy.	Poor: too sandy, wetness.
19----------- Granby	Poor: wetness.	Probable-----------	Improbable: too sandy.	Poor: too sandy, wetness.
20B, 20C----------- Tekenink	Good-----------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
20D----------- Tekenink	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
20E: Tekenink	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
21: Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
22A, 22B, 22C: Kalamazoo	Good	Probable	Probable	Poor: small stones, area reclaim.
22D: Kalamazoo	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
23: Lenawee	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
24B: Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
24C: Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
24D: Marlette	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
24E: Marlette	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
25*: Histosols.				
Aquents.				
26B: Matherton	Fair: shrink-swell, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
29C: Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
29D: Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
29E: Perrinton	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
31B, 31C: Oshtemo	Good	Probable	Probable	Poor: small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
31D Oshtemo	Fair: slope.	Probable	Probable	Poor: small stones, slope.
31E Oshtemo	Poor: slope.	Probable	Probable	Poor: small stones, slope.
32 Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
33 Parkhill	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
36 Sebewa	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
37B Selfridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
39 Sloan	Poor: wetness.	Probable	Probable	Poor: area reclaim, wetness.
40B Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
40C Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
40D Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
40E Spinks	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
47B Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
50B Kibbie	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
51A, 51B Marlette	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
53*. Pits				
55 Algansee	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
56A Thetford	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
57B, 57C Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
57D Coloma	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
57E Coloma	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
58B*, 58C*:				
Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
Boyer	Good	Probable	Probable	Poor: small stones, area reclaim.
58D*:				
Coloma	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
Boyer	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
58E*:				
Coloma	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
Boyer	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
59A Brems	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
60A, 60B Schoolcraft	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim.
63B Elston	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim.
67B*:				
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
67B*:				
Oshtemo	Good	Probable	Probable	Poor: small stones.
67C*:				
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Oshtemo	Good	Probable	Probable	Poor: small stones.
67D*:				
Marlette	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Oshtemo	Fair: slope.	Probable	Probable	Poor: small stones, slope.
67E*:				
Marlette	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Oshtemo	Poor: slope.	Probable	Probable	Poor: small stones, slope.
68B*:				
Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
68C*:				
Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
68D*:				
Coloma	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
Marlette	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
68E*:				
Coloma	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
Marlette	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(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 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--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
2----------------- Adrian	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing, rooting depth.	Wetness, rooting depth.
5B---------------- Ithaca	Slight---------	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness---------	Wetness, percs slowly.
6B---------------- Boyer	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
6C, 6D, 6E-------- Boyer	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
7A---------------- Brady	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action---	Wetness---------	Wetness.
9B---------------- Capac	Slight---------	Severe: piping, wetness.	Severe: slow refill.	Frost action---	Wetness, soil blowing.	Wetness.
13---------------- Colwood	Moderate: seepage.	Severe: thin layer, ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Ponding---------	Wetness, erodes easily.
15---------------- Edwards	Severe: seepage.	Severe: ponding, excess humus.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Wetness.
16*: Udorthents.						
Udipsamments.						
18---------------- Glendora	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, droughty.
19---------------- Granby	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
20B--------------- Tekenink	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Droughty.
20C, 20D, 20E----- Tekenink	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
21 Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Ponding, soil blowing.	Wetness.
22A Kalamazoo	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Favorable	Favorable.
22B Kalamazoo	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Slope	Favorable.
22C, 22D Kalamazoo	Severe: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope	Slope.
23 Lenawee	Slight	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Wetness, erodes easily, percs slowly.
24B Marlette	Moderate: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Rooting depth.
24C, 24D, 24E Marlette	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, rooting depth.
25*: Histosols.						
Aquents.						
26B Matherton	Severe: seepage.	Severe: thin layer, wetness.	Severe: slow refill.	Flooding, frost action.	Wetness	Wetness.
29C, 29D, 29E Perrinton	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly, erodes easily.	Slope, erodes easily, percs slowly.
31B Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Favorable.
31C, 31D, 31E Oshtemo	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
32 Palms	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness, rooting depth.
33 Parkhill	Slight	Severe: thin layer, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Wetness, erodes easily.
36 Sebewa	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding, percs slowly.	Wetness.
37B Selfridge	Severe: seepage.	Moderate: piping, wetness.	Severe: no water.	Frost action	Wetness, droughty.	Wetness, erodes easily, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
39 Sloan	Severe: seepage.	Severe: thin layer, wetness.	Severe: slow refill, cutbanks cave.	Flooding, frost action.	Wetness, flooding.	Wetness, erodes easily.
40B Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
40C, 40D, 40E Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
47B Perrinton	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.
50B Kibbie	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness, erodes easily.
51A Marlette	Slight	Severe: piping.	Severe: slow refill.	Favorable	Wetness, soil blowing.	Rooting depth.
51B Marlette	Moderate: slope.	Severe: piping.	Severe: slow refill.	Slope	Slope, wetness, soil blowing.	Rooting depth.
53*. Pits						
55 Algansee	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, flooding.	Wetness, droughty.
56A Thetford	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
57B Coloma	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
57C, 57D, 57E Coloma	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
58B*:						
Coloma	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Boyer	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
58C*, 58D*, 58E*:						
Coloma	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
58C*, 58D*, 58E*:						
Boyer	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
59A Brems	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Droughty.
60A Schoolcraft	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Favorable	Favorable.
60B Schoolcraft	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope	Favorable.
63B Elston	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Favorable.
67B*:						
Marlette	Moderate: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Rooting depth.
Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Favorable.
67C*, 67D*, 67E*:						
Marlette	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, rooting depth.
Oshtemo	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
68B*:						
Coloma	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Marlette	Moderate: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Rooting depth.
68C*, 68D*, 68E*:						
Coloma	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Marlette	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, rooting depth.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--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	
2----------------- Adrian	0-24	Muck-------------	PT	A-8	---	---	---	---	---	---	---
	24-60	Sand, fine sand, gravelly sand.	SP, SM, SP-SM	A-2, A-3, A-1	0	80-100	60-100	30-80	0-15	---	NP
5B---------------- Ithaca	0-8	Loam-------------	CL, ML, CL-ML	A-4, A-6	0-3	95-100	85-100	70-95	50-75	25-35	5-15
	8-29	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0-3	95-100	85-100	85-100	60-90	40-55	20-30
	29-60	Clay loam, silty clay loam.	CL, CH	A-7	0-3	95-100	85-100	85-100	60-90	40-55	20-30
6B, 6C, 6D, 6E--- Boyer	0-9	Loamy sand-------	SM, SP-SM	A-2, A-1	0-5	95-100	75-95	30-80	10-35	<20	NP-4
	9-19	Loamy sand, gravelly loamy sand, sandy loam.	SM, SM-SC	A-2, A-4, A-1-b	0-5	85-100	60-95	30-85	10-50	<20	NP-4
	19-33	Sandy loam, gravelly sandy loam, gravelly sandy clay loam.	SC, SM-SC, CL, CL-ML	A-2, A-4, A-1-b	0-5	80-100	60-95	35-90	15-75	20-30	5-10
	33-60	Gravelly sand, coarse sand, gravel.	SP, SP-SM, GP, GP-GM	A-1, A-2, A-3	0-10	40-95	30-85	20-60	0-10	---	NP
7A---------------- Brady	0-9	Sandy loam-------	SM, SM-SC, ML, CL-ML	A-2, A-4, A-1	0-5	95-100	75-100	45-85	20-55	<25	NP-7
	9-25	Sandy loam, sandy clay loam, gravelly sandy loam.	SM, SC, ML, CL	A-2, A-4, A-6, A-1	0-5	85-100	60-100	35-90	20-55	15-35	NP-15
	25-41	Loamy sand, sandy loam.	SM, SC, SP-SM, SM-SC	A-2, A-4, A-1	0-5	95-100	75-100	35-70	10-40	<30	NP-10
	41-60	Gravelly sand, coarse sand, gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-5	40-95	30-85	20-60	0-10	---	NP
9B---------------- Capac	0-8	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2	0-5	95-100	85-100	50-85	30-55	<25	NP-7
	8-20	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	75-100	50-85	25-45	5-20
	20-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	75-100	70-95	55-75	20-45	5-20
13---------------- Colwood	0-10	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	15-35	2-12
	10-24	Fine sandy loam, silty clay loam, silt loam.	CL	A-6, A-4, A-7	0	100	100	80-100	50-90	25-45	8-20
	24-60	Stratified silt loam to fine sand.	SM, ML, SC, CL	A-2, A-4	0	100	95-100	70-100	30-80	<25	NP-10
15---------------- Edwards	0-22	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	22-60	Marl-------------	---	---	0	100	95-100	80-90	60-80	---	---
16*: Udorthents.											

See footnote at end of table.

TABLE 16.--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	
16*: Udipsamments.											
18--------------- Glendora	0-6	Loamy fine sand	SP-SM, SM	A-2, A-1	0-5	95-100	90-100	45-80	10-35	<20	NP-4
	6-60	Stratified sand to fine sandy loam.	SP, SM, SP-SM	A-3, A-2-4, A-1-b	0-5	95-100	90-100	45-85	0-35	---	NP
19--------------- Granby	0-15	Sand-------------	SP-SM, SM	A-3, A-2	0	100	100	50-80	5-35	---	NP
	15-36	Sand, fine sand, loamy sand.	SP-SM, SM	A-3, A-2, A-1	0	100	95-100	45-80	5-35	---	NP
	36-60	Sand, fine sand, loamy sand.	SP-SM, SM	A-3, A-2, A-1	0	100	95-100	45-80	5-35	---	NP
20B, 20C, 20D, 20E------------- Tekenink	0-8	Fine sandy loam	SM, SM-SC, SC	A-4, A-2-4	0-10	95-100	80-100	55-85	25-50	<25	NP-10
	8-14	Fine sandy loam, sandy loam, loamy sand.	SM, SM-SC, SC	A-4, A-2-4	0-10	95-100	80-100	50-85	20-50	<25	NP-10
	14-52	Fine sandy loam, sandy loam, sandy clay loam.	SM-SC, SC, CL, CL-ML	A-4, A-2-4, A-2-6, A-6	0-10	95-100	80-100	55-85	25-55	<30	4-15
	52-60	Sandy loam, fine sandy loam, loamy sand.	SM, SC, SM-SC	A-4, A-2-4	0-10	95-100	80-100	50-95	20-45	<25	NP-10
21--------------- Houghton	0-14	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	14-60	Muck-------------	PT	A-8	0	---	---	---	---	---	---
22A, 22B, 22C, 22D------------- Kalamazoo	0-10	Loam-------------	ML, CL-ML, CL	A-4, A-6	0-5	95-100	70-100	65-90	50-70	<35	NP-15
	10-34	Sandy clay loam, gravelly sandy clay loam, gravelly sandy loam.	SC, CL	A-4, A-6, A-7, A-2	0-5	80-100	70-95	40-95	24-80	25-45	7-25
	34-44	Loamy coarse sand, loamy sand, very gravelly loamy sand.	SM, SP-SM, SM-SC	A-2-4, A-1-b	0-5	80-100	60-95	30-70	10-30	<25	NP-7
	44-60	Sand, gravelly sand, very gravelly sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-5	40-100	25-100	10-70	0-15	---	NP
23--------------- Lenawee	0-7	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	75-95	35-45	15-25
	7-23	Silty clay loam, silty clay, clay loam.	CH, CL	A-7	0	100	95-100	90-100	70-95	40-55	20-30
	23-60	Silt loam, silty clay loam, clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-95	25-50	10-25
24B, 24C, 24D, 24E------------- Marlette	0-9	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	85-95	80-95	60-70	20-30	3-10
	9-34	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	34-60	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 16.--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	
25*:											
Histosols.											
Aquents.											
26B-------------- Matherton	0-9	Loam-------------	CL, CL-ML	A-4	0	95-100	90-100	80-95	60-90	20-30	4-10
	9-24	Sandy clay loam, clay loam, sandy loam.	SC, CL	A-6, A-7	0	95-100	90-100	80-100	35-75	30-45	10-20
	24-57	Sand, gravel, loamy coarse sand.	GP, SP, SP-SM, GP-GM	A-1, A-3, A-2	0-10	40-80	35-70	30-55	0-10	---	NP
	57-74	Clay loam, silty clay, silty clay loam.	CL, CH	A-6, A-7	0-5	95-100	85-100	75-100	55-95	35-60	15-35
29C, 29D, 29E---- Perrinton	0-10	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-95	50-75	20-35	4-15
	10-32	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0-5	95-100	85-100	80-100	60-90	40-60	20-35
	32-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0-5	95-100	85-100	75-100	55-90	35-60	15-35
31B, 31C, 31D, 31E------------- Oshtemo	0-9	Sandy loam-------	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	85-95	50-85	25-55	<20	NP-4
	9-23	Sandy loam, sandy clay loam, gravelly sandy loam.	SC, SM-SC	A-2, A-4, A-1	0	80-100	55-95	35-85	15-50	20-30	4-10
	23-60	Loamy sand, sandy loam, gravelly loamy sand.	SM, SP-SM	A-2, A-1	0	80-95	55-95	35-70	10-35	---	NP
	60-80	Stratified sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
32--------------- Palms	0-11	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	11-32	Muck-------------	PT	A-8	---	---	---	---	---	---	---
	32-60	Loam, silt loam, clay loam.	CL-ML, CL, SC, SM-SC	A-4, A-6, A-7	0	90-100	75-100	65-95	45-90	20-45	5-20
33--------------- Parkhill	0-8	Loam-------------	CL-ML, CL	A-4, A-6	0-5	95-100	85-100	70-95	50-75	20-30	5-15
	8-25	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	85-100	70-100	60-95	25-45	10-25
	25-60	Loam, silt loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-95	50-90	20-35	5-15
36--------------- Sebewa	0-10	Loam-------------	CL-ML, CL	A-4, A-6	0	90-100	75-100	70-95	50-90	20-35	4-15
	10-29	Loam, sandy clay loam, silty clay loam.	CL, SC	A-6, A-7, A-2	0	95-100	75-90	60-90	25-85	25-45	10-25
	29-42	Sand and gravel	SP, SP-SM, GP, GP-GM	A-1	0-5	60-90	25-85	20-60	0-30	---	NP
	42-60	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-5	95-100	85-100	75-100	55-100	35-60	15-35

See footnote at end of table.

TABLE 16.--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	
37B-------------- Selfridge	0-7	Loamy sand-------	SM, SM-SC, SP-SM	A-2, A-1	0-5	95-100	90-100	45-80	10-35	<20	NP-5
	7-28	Sand, loamy sand, loamy fine sand.	SP-SM, SM, SM-SC	A-2, A-3, A-1	0-5	95-100	90-100	45-80	5-35	<20	NP-5
	28-47	Clay loam, sandy clay loam, loam.	SM, SC, ML, CL	A-2, A-4, A-6	0-5	95-100	85-100	70-95	50-75	15-35	NP-15
	47-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	70-100	50-95	25-45	10-20
39--------------- Sloan	0-20	Loam-------------	CL, CL-ML	A-4, A-6	0	90-100	85-95	75-95	55-85	20-35	5-15
	20-48	Stratified sandy loam to silty clay loam.	CL-ML, CL, SC, SM-SC	A-4, A-6, A-7	0	85-95	80-95	45-95	35-85	25-45	5-20
	48-60	Coarse sand, gravelly sand, sand.	SP, SP-SM, SM	A-1, A-3, A-2	0-5	55-90	50-90	20-60	3-15	---	NP
40B, 40C, 40D, 40E------------- Spinks	0-11	Loamy sand-------	SM, SM-SC, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	11-28	Loamy sand, sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	28-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SM-SC	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
47B-------------- Perrinton	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-95	50-75	20-35	4-15
	8-26	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0-5	95-100	85-100	80-100	50-90	40-60	20-35
	26-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0-5	95-100	85-100	75-100	55-90	35-60	15-35
50B-------------- Kibbie	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-95	<35	NP-15
	9-24	Silt loam, silty clay loam, clay loam.	CL	A-4, A-6, A-7	0	90-100	85-100	80-100	65-90	25-45	9-25
	24-60	Stratified silt loam to fine sand.	ML, SM, SC, CL	A-4, A-2	0	100	95-100	70-95	30-80	<30	NP-10
51A, 51B--------- Marlette	0-8	Fine sandy loam	SM, SM-SC	A-4, A-2	0-5	95-100	85-95	60-70	30-40	<25	NP-7
	8-30	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	30-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
53*. Pits											
55--------------- Algansee	0-12	Loamy fine sand	SM, SM-SC	A-2-4	0	100	100	50-75	15-35	<25	NP-7
	12-60	Stratified sand to sandy loam.	SM, SP-SM	A-3, A-2-4	0	100	100	50-80	5-35	---	NP

See footnote at end of table.

TABLE 16.--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	
56A Thetford	0-8	Loamy sand	SM, SM-SC, SP-SM	A-2, A-4, A-1-b	0	95-100	90-100	45-80	10-45	<25	NP-7
	8-22	Sand, loamy sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2, A-3, A-1-b	0	95-100	90-100	45-80	5-35	<25	NP-7
	22-62	Loamy sand, fine sandy loam, sand.	SM, SM-SC, SC	A-2, A-4	0	95-100	90-100	60-80	20-50	<30	NP-10
57B, 57C, 57D, 57E Coloma	0-9	Loamy sand	SM	A-2, A-4	0-8	75-100	75-100	50-90	15-50	---	NP
	9-25	Sand, loamy sand	SP, SM, SP-SM	A-2, A-3	0-8	75-100	75-100	50-75	2-30	---	NP
	25-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-8	75-100	75-100	50-100	2-40	---	NP
58B*, 58C*, 58D*, 58E*:											
Coloma	0-9	Loamy sand	SM	A-2, A-4	0-8	75-100	75-100	50-90	15-50	---	NP
	9-25	Sand, loamy sand	SP, SM, SP-SM	A-2, A-3	0-8	75-100	75-100	50-75	2-30	---	NP
	25-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-8	75-100	75-100	50-100	2-40	---	NP
Boyer	0-9	Loamy sand	SM, SP-SM	A-2, A-1	0-5	95-100	75-95	30-80	10-35	<20	NP-4
	9-19	Loamy sand, gravelly loamy sand, sandy loam.	SM, SM-SC	A-2, A-4, A-1-b	0-5	85-100	60-95	30-85	10-50	<20	NP-4
	19-33	Sandy loam, gravelly sandy loam, gravelly sandy clay loam.	SC, SM-SC, CL, CL-ML	A-2, A-4, A-1-b	0-5	80-100	60-95	35-90	15-75	20-30	5-10
	33-60	Gravelly sand, coarse sand, gravel.	SP, SP-SM, GP, GP-GM	A-1, A-2, A-3	0-10	40-95	30-85	20-60	0-10	---	NP
59A Brems	0-7	Sand	SM, SP-SM	A-2-4, A-3	0	100	85-100	50-85	5-15	---	NP
	7-39	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
	39-60	Sand, fine sand, loamy fine sand.	SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-10	---	NP
60A, 60B Schoolcraft	0-15	Loam	CL-ML, CL	A-4	0	95-100	85-100	70-95	50-75	20-30	5-10
	15-27	Clay loam, loam, sandy clay loam.	CL, SC	A-6, A-7	0	90-100	85-100	70-95	35-75	25-45	10-20
	27-36	Sandy loam	SM-SC, SC	A-2, A-4	0	90-100	85-100	50-70	25-40	20-30	5-10
	36-60	Sand, gravelly sand, loamy sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	75-100	70-95	35-65	0-15	---	NP
63B Elston	0-18	Sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	60-85	30-55	<20	NP-5
	18-28	Sandy loam, loam, sandy clay loam.	SM, SM-SC, ML, CL-ML	A-4	0	95-100	75-95	50-80	35-65	<25	NP-7
	28-60	Loamy sand, sandy loam.	SP-SM, SM	A-2-4, A-3, A-1-b	0-3	95-100	75-95	45-75	5-30	<20	NP

See footnote at end of table.

TABLE 16.--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	
67B*, 67C*, 67D*, 67E*:											
Marlette	0-9	Loam	CL, ML, CL-ML	A-4	0-5	95-100	85-95	80-95	60-70	20-30	3-10
	9-34	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	34-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
Oshtemo	0-9	Sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	85-95	50-85	25-55	<20	NP-4
	9-23	Sandy loam, sandy clay loam, gravelly sandy loam.	SC, SM-SC	A-2, A-4, A-1	0	80-100	55-95	35-85	15-50	20-30	4-10
	23-60	Loamy sand, sandy loam, sand.	SM, SP-SM	A-2, A-1	0	80-95	55-95	35-70	10-35	---	NP
	60-80	Stratified sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
68B*, 68C*, 68D*, 68E*:											
Coloma	0-9	Loamy sand	SM	A-2, A-4	0-8	75-100	75-100	50-90	15-50	---	NP
	9-25	Sand, loamy sand	SP, SM, SP-SM	A-2, A-3	0-8	75-100	75-100	50-75	2-30	---	NP
	25-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-8	75-100	75-100	50-100	2-40	---	NP
Marlette	0-9	Loam	CL, ML, CL-ML	A-4	0-5	95-100	85-95	80-95	60-70	20-30	3-10
	9-34	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	34-60	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 description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--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 erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
2-------------- Adrian	0-24	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.3	-------------	----	4	2	55-75
	24-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.1-8.4	Low----------	0.15			
5B-------------- Ithaca	0-8	8-27	1.40-1.70	0.6-2.0	0.18-0.22	5.1-7.3	Low----------	0.32	3	5	1-4
	8-29	35-50	1.40-1.65	0.06-0.2	0.10-0.20	5.1-7.8	Moderate-----	0.32			
	29-60	30-40	1.50-1.65	0.06-0.2	0.13-0.20	7.9-8.4	Moderate-----	0.32			
6B, 6C, 6D, 6E--- Boyer	0-9	0-10	1.35-1.60	6.0-20	0.08-0.12	5.6-7.3	Low----------	0.17	4	2	.5-3
	9-19	2-15	1.30-1.60	2.0-6.0	0.08-0.16	5.6-7.3	Low----------	0.17			
	19-33	10-18	1.35-1.60	2.0-6.0	0.11-0.13	5.6-7.8	Low----------	0.24			
	33-60	0-10	1.40-1.55	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
7A-------------- Brady	0-9	2-15	1.35-1.55	2.0-6.0	0.12-0.16	5.1-7.3	Low----------	0.20	5	3	2-4
	9-25	5-22	1.35-1.55	2.0-6.0	0.12-0.17	5.1-6.5	Low----------	0.24			
	25-41	5-20	1.35-1.50	2.0-6.0	0.08-0.13	5.1-7.3	Low----------	0.20			
	41-60	0-10	1.40-1.50	>20	0.02-0.04	6.6-8.4	Low----------	0.10			
9B-------------- Capac	0-8	5-15	1.40-1.70	2.0-6.0	0.13-0.16	5.6-7.3	Low----------	0.24	5	3	1-3
	8-20	18-35	1.45-1.70	0.2-0.6	0.14-0.18	5.6-7.3	Low----------	0.32			
	20-60	10-35	1.50-1.70	0.2-0.6	0.14-0.17	7.4-8.4	Low----------	0.32			
13-------------- Colwood	0-10	5-26	1.30-1.60	0.6-2.0	0.20-0.24	6.1-7.8	Low----------	0.28	5	5	3-8
	10-24	18-35	1.30-1.60	0.2-0.6	0.17-0.22	6.1-7.8	Moderate-----	0.43			
	24-60	0-12	1.45-1.65	0.6-2.0	0.08-0.22	7.4-8.4	Low----------	0.43			
15-------------- Edwards	0-22	---	0.30-0.55	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	4	2	55-75
	22-60	---	---	---	---	7.4-8.4	-------------	----			
16*: Udorthents.											
Udipsamments.											
18-------------- Glendora	0-6	5-15	1.35-1.50	6.0-20	0.10-0.12	5.6-7.8	Low----------	0.17	5	2	4-12
	6-60	0-10	1.40-1.65	6.0-20	0.05-0.11	5.6-7.8	Low----------	0.17			
19-------------- Granby	0-15	2-10	1.20-1.60	6.0-20	0.07-0.10	5.6-7.3	Low----------	0.15	5	1	4-10
	15-36	0-14	1.45-1.60	6.0-20	0.05-0.12	5.6-7.8	Low----------	0.17			
	36-60	0-10	1.45-1.60	6.0-20	0.05-0.09	6.6-8.4	Low----------	0.17			
20B, 20C, 20D, 20E------------ Tekenink	0-8	2-15	1.30-1.60	0.6-2.0	0.10-0.18	5.1-7.3	Low----------	0.24	5	3	1-3
	8-14	2-15	1.45-1.60	0.6-2.0	0.08-0.17	5.1-7.3	Low----------	0.24			
	14-52	10-22	1.55-1.70	0.6-2.0	0.10-0.17	5.1-7.3	Low----------	0.24			
	52-60	2-15	1.55-1.70	0.6-6.0	0.08-0.16	7.4-8.4	Low----------	0.24			
21-------------- Houghton	0-14	---	0.30-0.45	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	5	2	>70
	14-60	---	0.15-0.30	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----			
22A, 22B, 22C, 22D------------ Kalamazoo	0-10	8-25	1.30-1.65	0.6-2.0	0.16-0.22	5.1-7.3	Low----------	0.32	4	5	1-3
	10-34	18-35	1.35-1.70	0.6-2.0	0.10-0.18	5.1-7.3	Moderate-----	0.32			
	34-44	2-15	1.50-1.65	6.0-20	0.02-0.08	5.1-7.8	Low----------	0.15			
	44-60	0-10	1.50-1.65	6.0-20	0.01-0.03	7.4-8.4	Low----------	0.10			

See footnote at end of table.

TABLE 17.--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 erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
23---------------- Lenawee	0-7	27-35	1.40-1.55	0.6-2.0	0.17-0.26	5.6-7.8	Moderate-----	0.28	3	7	3-12
	7-23	35-45	1.40-1.65	0.06-0.2	0.14-0.20	6.1-7.8	Moderate-----	0.37			
	23-60	18-40	1.50-1.65	0.06-0.2	0.16-0.22	7.4-8.4	Moderate-----	0.37			
24B, 24C, 24D, 24E------------- Marlette	0-9	10-18	1.50-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.32	5	5	1-3
	9-34	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low----------	0.32			
	34-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low----------	0.32			
25*: Histosols.											
Aquents.											
26B-------------- Matherton	0-9	10-20	1.30-1.70	0.6-2.0	0.18-0.24	6.6-7.3	Low----------	0.28	4	5	4-6
	9-24	20-35	1.40-1.70	0.6-2.0	0.13-0.19	6.1-7.3	Moderate-----	0.28			
	24-57	0-10	1.50-1.70	>20	0.02-0.04	7.9-8.4	Low----------	0.10			
	57-74	35-55	1.65-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate-----	0.32			
29C, 29D, 29E---- Perrinton	0-10	10-27	1.50-1.70	0.6-2.0	0.20-0.24	5.6-7.8	Low----------	0.37	3	5	1-3
	10-32	35-50	1.50-1.70	0.06-0.2	0.10-0.20	5.6-8.4	Moderate-----	0.32			
	32-60	30-56	1.65-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate-----	0.32			
31B, 31C, 31D, 31E------------- Oshtemo	0-9	2-12	1.35-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low----------	0.24	5	3	.5-3
	9-23	10-18	1.30-1.60	2.0-6.0	0.12-0.19	5.1-6.5	Low----------	0.24			
	23-60	5-15	1.30-1.60	2.0-6.0	0.06-0.10	5.1-7.3	Low----------	0.17			
	60-80	0-15	1.30-1.50	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
32--------------- Palms	0-11	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----	5	2	>75
	11-32	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8	-------------	----			
	32-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low----------	0.37			
33--------------- Parkhill	0-8	10-20	1.10-1.60	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.24	5	5	3-5
	8-25	18-35	1.45-1.70	0.2-0.6	0.15-0.19	6.1-7.8	Moderate-----	0.32			
	25-60	12-25	1.50-1.70	0.2-0.6	0.17-0.19	7.4-8.4	Low----------	0.37			
36--------------- Sebewa	0-10	10-25	1.15-1.60	0.6-2.0	0.22-0.24	6.6-7.8	Low----------	0.24	4	5	1-4
	10-29	18-35	1.50-1.70	0.6-2.0	0.15-0.19	6.6-7.8	Moderate-----	0.32			
	29-42	0-5	1.55-1.70	6.0-20	0.03-0.05	7.9-8.4	Low----------	0.10			
	42-60	35-55	1.65-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate-----	0.32			
37B-------------- Selfridge	0-7	2-15	1.25-1.40	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	1-3
	7-28	2-15	1.30-1.60	6.0-20	0.07-0.11	5.1-7.3	Low----------	0.17			
	28-47	8-18	1.35-1.45	6.0-20	0.12-0.14	5.1-7.3	Low----------	0.28			
	47-60	18-35	1.50-1.70	0.2-0.6	0.10-0.14	5.1-8.4	Low----------	0.37			
39--------------- Sloan	0-20	15-27	1.20-1.40	0.6-2.0	0.19-0.24	6.1-7.8	Low----------	0.28	5	6	3-6
	20-48	18-30	1.25-1.55	0.2-2.0	0.19-0.21	6.6-8.4	Low----------	0.37			
	48-60	0-10	1.20-1.50	6.0-20	0.02-0.05	6.6-8.4	Low----------	0.10			
40B, 40C, 40D, 40E------------- Spinks	0-11	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low----------	0.17	5	2	2-4
	11-28	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low----------	0.17			
	28-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low----------	0.17			
47B-------------- Perrinton	0-8	10-27	1.50-1.70	0.6-2.0	0.20-0.24	5.6-7.8	Low----------	0.37	3	5	1-3
	8-26	35-50	1.50-1.75	0.06-0.2	0.10-0.20	5.6-8.4	Moderate-----	0.37			
	26-60	30-50	1.65-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate-----	0.37			

See footnote at end of table.

TABLE 17.--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 erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
50B-------------- Kibbie	0-9	5-25	1.40-1.65	0.6-2.0	0.16-0.24	5.6-7.3	Low-----------	0.28	5	5	2-3
	9-24	18-35	1.40-1.65	0.6-2.0	0.17-0.22	5.6-7.8	Low-----------	0.43			
	24-60	2-18	1.40-1.70	0.6-2.0	0.12-0.22	7.4-8.4	Low-----------	0.43			
51A, 51B--------- Marlette	0-8	10-18	1.50-1.65	2.0-6.0	0.12-0.15	5.6-7.3	Low-----------	0.24	5	3	1-3
	8-30	18-30	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low-----------	0.32			
	30-60	15-25	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low-----------	0.32			
53*. Pits											
55--------------- Algansee	0-12	0-15	1.35-1.50	6.0-20	0.10-0.12	5.6-7.8	Low-----------	0.17	5	2	1-4
	12-60	0-15	1.40-1.65	6.0-20	0.05-0.10	5.6-8.4	Low-----------	0.17			
56A-------------- Thetford	0-8	2-15	1.30-1.60	2.0-6.0	0.09-0.11	5.6-7.3	Low-----------	0.17	5	2	1-4
	8-22	2-15	1.30-1.60	2.0-20	0.07-0.11	5.1-7.3	Low-----------	0.17			
	22-62	8-18	1.45-1.65	2.0-6.0	0.06-0.08	5.1-7.8	Low-----------	0.17			
57B, 57C, 57D, 57E------------- Coloma	0-9	2-10	1.35-1.65	6.0-20	0.08-0.12	4.5-7.3	Low-----------	0.17	5	2	<1
	9-25	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low-----------	0.15			
	25-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low-----------	0.15			
58B*, 58C*, 58D*, 58E*:											
Coloma---------	0-9	2-10	1.35-1.65	6.0-20	0.08-0.12	4.5-7.3	Low-----------	0.17	5	2	<1
	9-25	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low-----------	0.15			
	25-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low-----------	0.15			
Boyer----------	0-9	0-10	1.35-1.60	6.0-20	0.08-0.12	5.6-7.3	Low-----------	0.17	4	2	.5-3
	9-19	2-15	1.30-1.60	2.0-6.0	0.08-0.16	5.6-7.3	Low-----------	0.17			
	19-33	10-18	1.35-1.60	2.0-6.0	0.11-0.13	5.6-7.8	Low-----------	0.24			
	33-60	0-10	1.40-1.55	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
59A-------------- Brems	0-7	2-6	1.50-1.65	6.0-20	0.07-0.09	5.1-6.5	Low-----------	0.15	5	1	.5-1
	7-39	2-6	1.60-1.75	6.0-20	0.05-0.08	4.5-6.5	Low-----------	0.17			
	39-60	2-6	1.60-1.75	6.0-20	0.05-0.07	5.1-6.5	Low-----------	0.17			
60A, 60B--------- Schoolcraft	0-15	12-20	1.30-1.60	0.6-2.0	0.18-0.22	5.6-7.3	Low-----------	0.28	4	5	1-3
	15-27	18-35	1.40-1.70	0.6-2.0	0.12-0.19	4.5-7.3	Moderate-----	0.28			
	27-36	12-20	1.30-1.70	0.6-2.0	0.10-0.14	4.5-7.3	Low-----------	0.20			
	36-60	0-10	1.50-1.60	6.0-20	0.02-0.07	5.6-8.4	Low-----------	0.10			
63B-------------- Elston	0-18	8-15	1.35-1.45	2.0-6.0	0.12-0.15	5.1-7.3	Low-----------	0.20	4	3	1-5
	18-28	10-18	1.35-1.60	2.0-6.0	0.12-0.18	5.1-6.5	Low-----------	0.20			
	28-60	4-10	1.45-1.65	6.0-20	0.08-0.13	5.1-6.5	Low-----------	0.20			
67B*, 67C*, 67D*, 67E*:											
Marlette-------	0-9	10-18	1.50-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low-----------	0.32	5	5	1-3
	9-34	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low-----------	0.32			
	34-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low-----------	0.32			
Oshtemo--------	0-9	2-12	1.35-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low-----------	0.24	5	3	.5-3
	9-23	10-18	1.30-1.60	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	23-60	5-15	1.30-1.60	2.0-6.0	0.06-0.10	5.1-7.3	Low-----------	0.17			
	60-80	0-15	1.30-1.50	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			

See footnote at end of table.

TABLE 17.--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 erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
68B*, 68C*, 68D*, 68E*:											
Coloma---------	0-9	2-10	1.35-1.65	6.0-20	0.08-0.12	4.5-7.3	Low-----------	0.17	5	2	<1
	9-25	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low-----------	0.15			
	25-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low-----------	0.15			
Marlette-------	0-9	10-18	1.50-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low-----------	0.32	5	5	1-3
	9-34	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low-----------	0.32			
	34-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low-----------	0.32			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "occasional," "brief," "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	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
2----------------- Adrian	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	1-4	29-33	High-----	High-----	Moderate.
5B----------------- Ithaca	C	None---------	---	---	1.0-2.0	Apparent	Oct-May	---	---	High-----	High-----	Moderate.
6B, 6C, 6D, 6E---- Boyer	B	None---------	---	---	>6.0	---	---	---	---	Moderate	Low------	Moderate.
7A----------------- Brady	B	None---------	---	---	1.0-3.0	Apparent	Nov-May	---	---	High-----	Low------	Moderate.
9B----------------- Capac	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	---	High-----	High-----	Low.
13----------------- Colwood	B/D	None---------	---	---	+1-1.0	Apparent	Oct-May	---	---	High-----	High-----	Low.
15----------------- Edwards	B/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	4-12	25-30	High-----	High-----	Low.
16*: Udorthents.												
Udipsamments.												
18----------------- Glendora	A/D	Frequent----	Long------	Jan-Dec	0-1.0	Apparent	Nov-Jun	---	---	Moderate	High-----	Moderate.
19----------------- Granby	A/D	None---------	---	---	+1-1.0	Apparent	Nov-Jun	---	---	Moderate	High-----	Low.
20B, 20C, 20D, 20E-------------- Tekenink	B	None---------	---	---	>6.0	---	---	---	---	Moderate	Low------	Moderate.
21----------------- Houghton	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	1-4	55-60	High-----	High-----	Moderate.
22A, 22B, 22C, 22D-------------- Kalamazoo	B	None---------	---	---	>6.0	---	---	---	---	Moderate	Low------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
23----------------- Lenawee	B/D	None---------	---	---	+1-1.0	Apparent	Nov-May	---	---	High-----	High-----	Low.
24B, 24C, 24D, 24E--------------- Marlette	B	None---------	---	---	>6.0	---	---	---	---	Moderate	Low------	Moderate.
25*: Histosols.												
Aquents.												
26B---------------- Matherton	B	Occasional	Brief-----	Feb-Apr	1.0-3.0	Apparent	Dec-Jun	---	---	High-----	Moderate	Low.
29C, 29D, 29E----- Perrinton	C	None---------	---	---	>6.0	---	---	---	---	Moderate	High-----	Moderate.
31B, 31C, 31D, 31E--------------- Oshtemo	B	None---------	---	---	>6.0	---	---	---	---	Moderate	Low------	High.
32----------------- Palms	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	2-4	25-32	High-----	High-----	Moderate.
33----------------- Parkhill	B/D	None---------	---	---	+1-1.0	Apparent	Nov-May	---	---	High-----	High-----	Low.
36----------------- Sebewa	B/D	None---------	---	---	+1-1.0	Apparent	Sep-May	---	---	High-----	High-----	Low.
37B---------------- Selfridge	B	None---------	---	---	1.0-2.0	Perched	Nov-May	---	---	High-----	High-----	Low.
39----------------- Sloan	B/D	Frequent----	Brief-----	Nov-Jun	0-1.0	Apparent	Nov-Jun	---	---	High-----	High-----	Low.
40B, 40C, 40D, 40E--------------- Spinks	A	None---------	---	---	>6.0	---	---	---	---	Low------	Low------	Low.
47B---------------- Perrinton	C	None---------	---	---	2.5-6.0	Apparent	Nov-Apr	---	---	Moderate	High-----	Moderate.
50B---------------- Kibbie	B	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	---	High-----	High-----	Moderate.
51A, 51B---------- Marlette	B	None---------	---	---	2.5-6.0	Apparent	Dec-Apr	---	---	Moderate	Low------	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
53*. Pits												
55----------------- Algansee	B	Occasional	Long------	Nov-May	1.0-2.0	Apparent	Nov-May	---	---	Moderate	Low------	Low.
56A---------------- Thetford	A	None--------	---	---	1.0-2.0	Apparent	Feb-May	---	---	Moderate	Low------	Moderate.
57B, 57C, 57D, 57E-------------- Coloma	A	None--------	---	---	>6.0	---	---	---	---	Low------	Low------	Moderate.
58B*, 58C*, 58D*, 58E*:												
Coloma-----------	A	None--------	---	---	>6.0	---	---	---	---	Low------	Low------	Moderate.
Boyer------------	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Low------	Moderate.
59A---------------- Brems	A	None--------	---	---	2.0-3.0	Apparent	Jan-Apr	---	---	Low------	Low------	High.
60A, 60B----------- Schoolcraft	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Low------	Moderate.
63B---------------- Elston	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Low------	Moderate.
67B*, 67C*, 67D*, 67E*:												
Marlette---------	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Low------	Moderate.
Oshtemo----------	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Low------	High.
68B*, 68C*, 68D*, 68E*:												
Coloma-----------	A	None--------	---	---	>6.0	---	---	---	---	Low------	Low------	Moderate.
Marlette---------	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Low------	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--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
*Algansee	Mixed, mesic Aquic Udipsamments
Aquents	Mixed, nonacid, mesic Aquents
Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
Brady	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Brems	Mixed, mesic Aquic Udipsamments
*Capac	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Coloma	Mixed, mesic Alfic Udipsamments
Colwood	Fine-loamy, mixed, mesic Typic Haplaquolls
Edwards	Marly, euic, mesic Limnic Medisaprists
Elston	Coarse-loamy, mixed, mesic Typic Argiudolls
Glendora	Mixed, mesic Mollic Psammaquents
Granby	Sandy, mixed, mesic Typic Haplaquolls
Histosols	Euic, mesic Histosols
Houghton	Mixed, euic, mesic Typic Medisaprists
Ithaca	Fine, mixed, mesic Glossaquic Hapludalfs
Kalamazoo	Fine-loamy, mixed, mesic Typic Hapludalfs
*Kibbie	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Lenawee	Fine, mixed, nonacid, mesic Mollic Haplaquepts
Marlette	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Matherton	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Udollic Ochraqualfs
Oshtemo	Coarse-loamy, mixed, mesic Typic Hapludalfs
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Parkhill	Fine-loamy, mixed, nonacid, mesic Mollic Haplaquepts
Perrinton	Fine, mixed, mesic Glossoboric Hapludalfs
Schoolcraft	Fine-loamy, mixed, mesic Typic Argiudolls
*Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Selfridge	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs
Tekenink	Coarse-loamy, mixed, mesic Glossoboric Hapludalfs
Thetford	Sandy, mixed, mesic Psammaquentic Hapludalfs
Udipsamments	Mixed, mesic Udipsamments
Udorthents	Loamy, mixed, nonacid, mesic Udorthents

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