SOIL SURVEY OF

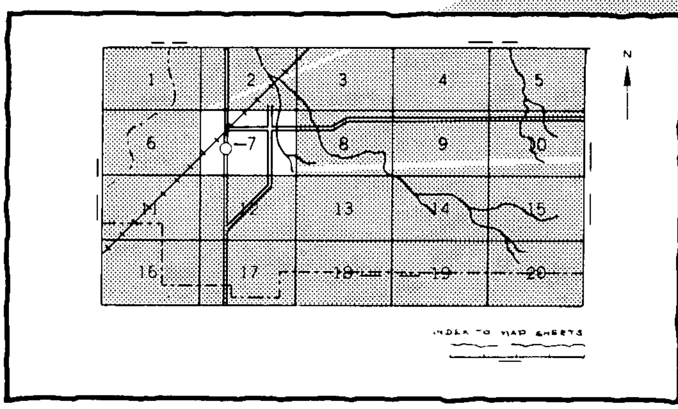
Bay County, Michigan

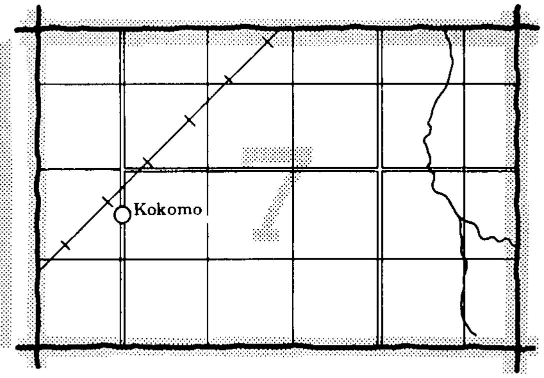
United States Department of Agriculture
Soil Conservation Service

in cooperation with
Michigan Agricultural Experiment Station

HOW TO USE

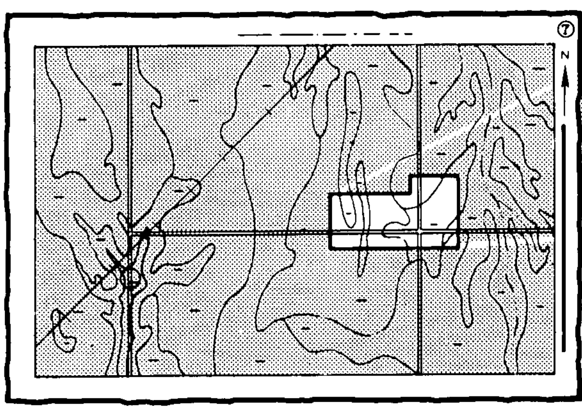
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

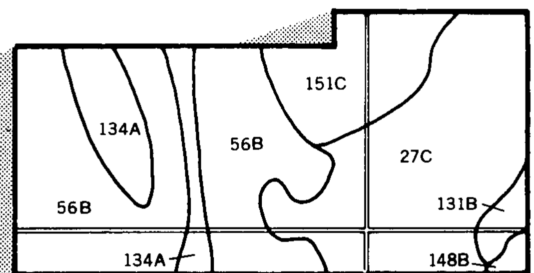




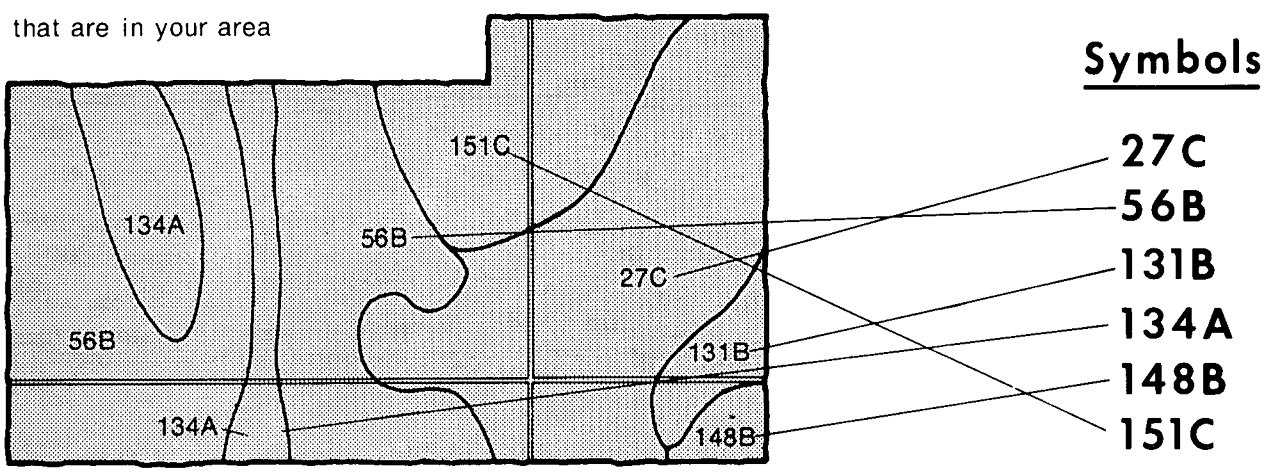
2. Note the number of the map sheet and turn to that sheet.

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



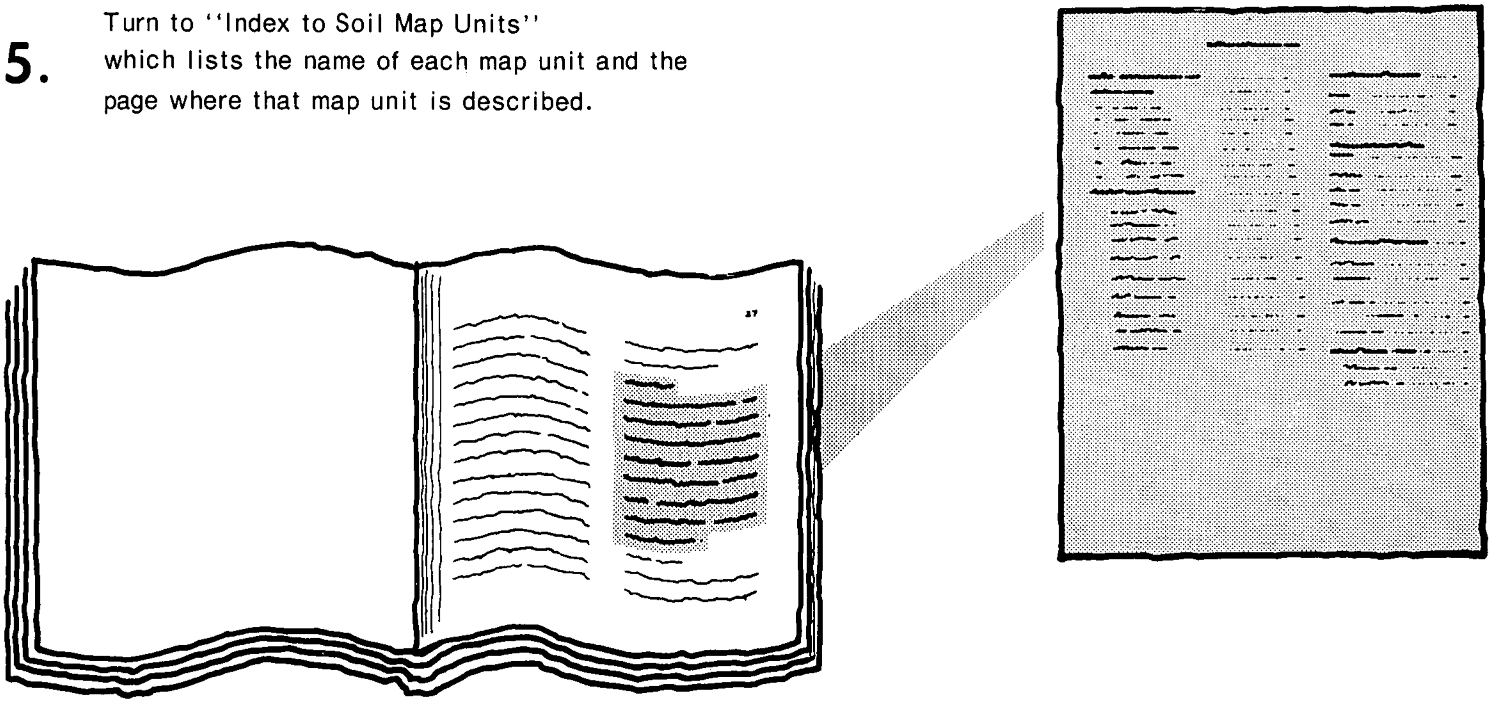


4. List the map unit symbols that are in your area

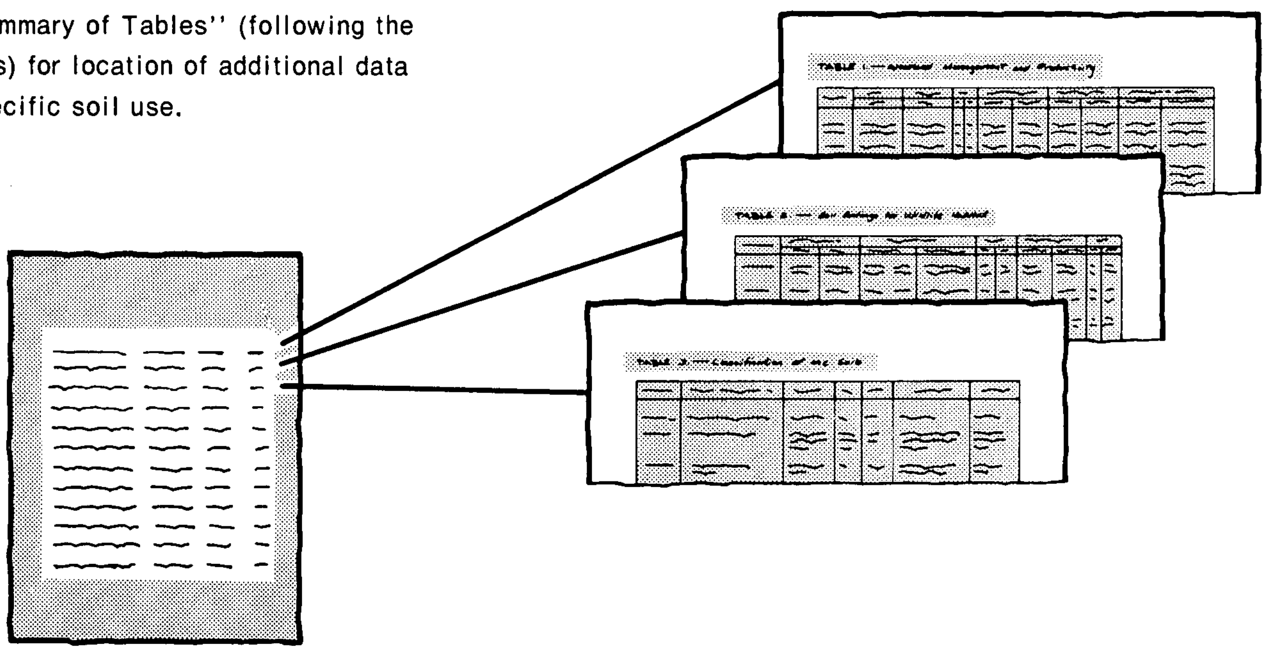


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was performed in the period 1975 to 1977. Soil names and descriptions were approved in August 1977. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and the Michigan Agricultural Experiment Station. It is part of the technical assistance furnished to the Bay County Soil Conservation District. This soil survey was partly financed by the Bay County Board of Commissioners under provisions of an agreement with the Soil Conservation Service.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Potato field on Belleville soil is protected from soil blowing by rye strips and autumn-olive hedgerow.

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Issued January 1980

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Foreword

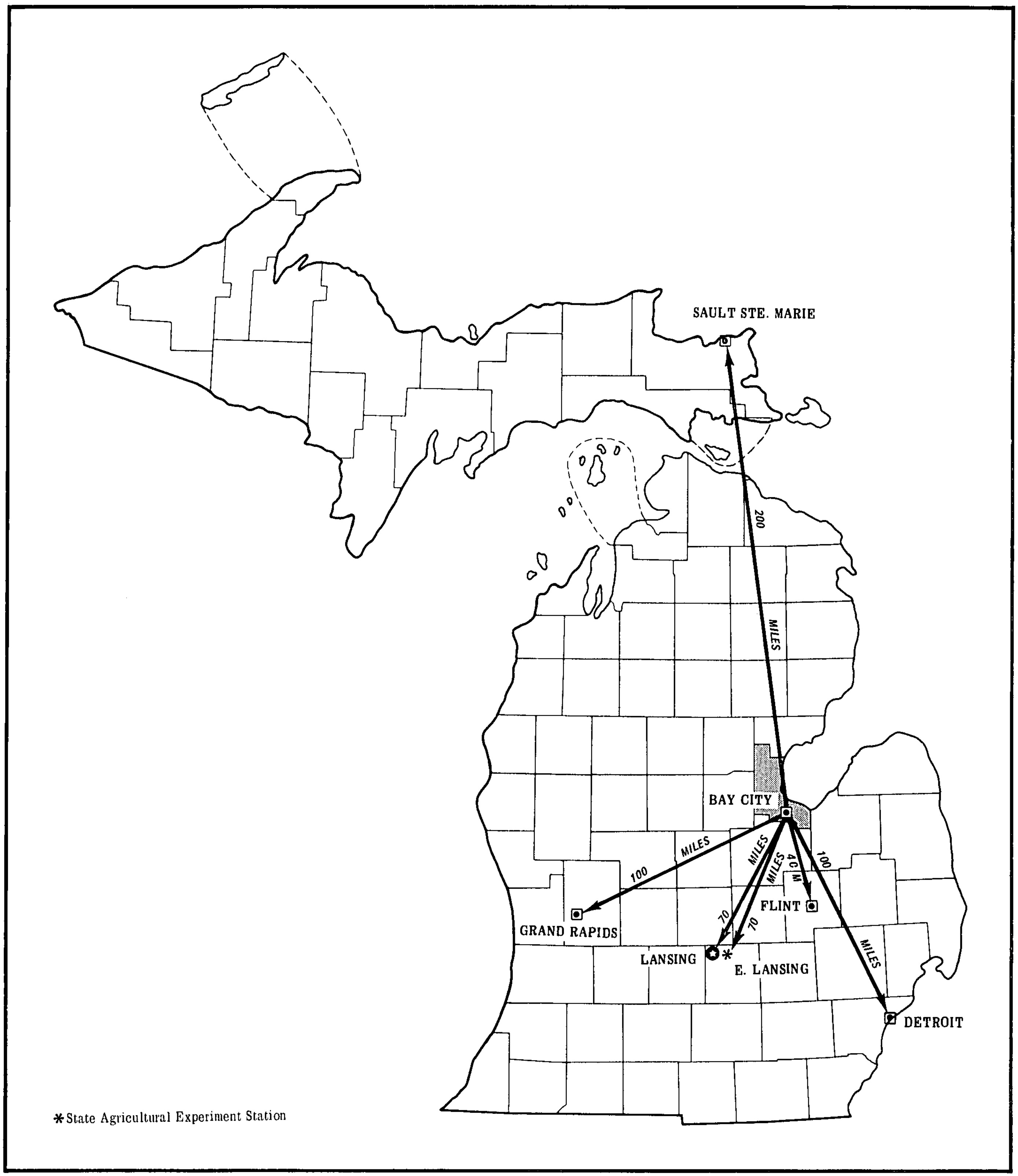
This soil survey contains much information useful in land-planning programs in Bay County. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be 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 kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Arthur H. Cratty
State Conservationist
Soil Conservation Service



Location of Bay County in Michigan.

SOIL SURVEY OF BAY COUNTY, MICHIGAN

By Glenn A. Weesies, Soil Conservation Service

Fieldwork by Glenn A. Weesies, Soil Conservation Service, and
Martin J. Wissmueller, Robert L. McLeese, Erik P. Johnson, Gary M. Geosling,
David J. Hvizdak, and William L. Kowalski, soil scientists, Bay County

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

BAY COUNTY is in the east-central part of the lower peninsula of Michigan along the shore of Saginaw Bay. The county is bordered on the south by Saginaw County, on the west by Midland and Gladwin Counties, on the north by Arenac County, and on the east by Saginaw Bay and Tuscola County. It has a land area of 288,640 acres, or 451 square miles. Bay City, the county seat, has a population of about 49,000.

General nature of the county

This section gives general information about the county. It discusses climate, history and development, industry and transportation, and lakes and streams.

Climate

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Bay City for the period 1947 to 1976. 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 24.9 degrees F, and the average daily minimum temperature is 17.9 degrees. The lowest temperature on record, which occurred at Bay City on February 5, 1918, is -31 degrees. In summer the average temperature is 69.8 degrees, and the average daily maximum temperature is 80.4 degrees. The highest recorded temperature, which occurred on July 9, 1911, is 110 degrees.

Growing degree days, shown in table 1, 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.

Of the total annual precipitation, 16.37 inches, or 59 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 13.7 inches. The heaviest 24-hour rainfall during the period of record was 6.81 inches at Bay City in August 1913. Thunderstorms occur on about 33 days each year, and most occur in June, July, and August.

Average seasonal snowfall is 39.6 inches. The greatest snow depth at any one time during the period of record was 24 inches. On the average, 60 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 61 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 65 in summer and 30 in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in March.

Climatic data in this section were specially prepared for the Soil Conservation Service by the Michigan Department of Agriculture, Michigan Weather Service, East Lansing, Michigan.

History and development

The area that is now Bay County was inhabited about 4,000 years ago by the "Old Copper" Indians. From about 500 B.C. to 700 A.D. the "Hopewell" Indians occupied the area. They were the builders of the burial mounds found in the county (*3*).

The Sauk Indians also were early inhabitants of the area. When they were driven out of Michigan, the Indians that remained were mainly from the Chippewa (Ojibway) Tribe. They later became known as the Saginaw Indians.

Frenchmen were early visitors to the area. They came mainly to trade for furs and made no permanent settlements. The first permanent settlement dates back to 1831.

Bay County was established in 1857. It had been part of Saginaw County.

Agriculture and lumbering were the earliest enterprises in the county. Lumbering centered along the Saginaw River. The lumber industry peaked in the mid 1880's. As it declined, agriculture and other industries began to thrive.

Industry and transportation

About 150 industries in Bay County manufacture various items, including automobile parts and accessories, cranes and shovels, airplane parts, jet engine components, aerospace equipment, electric devices, welding equipment, corrugated boxes, metal castings, magnesium products, cement, tubing, prefabricated houses, petroleum products, chemicals, sporting goods, clothing, and food, including cheese, sugar, and potato chips.

Bay City is one of the major ports in Michigan.

The county is served by two airports. One accommodates small private planes and charter flights, and the other provides regularly scheduled freight and passenger service.

Three railroads run through Bay County. In the southern part of the county, the Chesapeake and Ohio Railroad runs approximately parallel to the Saginaw River from Bay City into Saginaw County. The Grand Trunk Western Railroad has several lines that run throughout the county, and the Detroit and Mackinac Railroad runs north from Bay City into Arenac County.

One interstate highway, two U.S. highways, and five state highways link Bay County to all points in the state.

Lakes and streams

Bay County has many miles of frontage on Saginaw Bay. Saginaw Bay is important in commercial navigation and is used extensively for recreation. In the south-central part of the county, the Saginaw River flows into Saginaw Bay and gives the county access to Lake Huron and ocean shipping. There are many docks for commercial vessels and many marinas for pleasure craft along the Saginaw River. The Saginaw River and its tributaries are important to drainage of agricultural land.

Also important to drainage and recreation are the Quanicassee River near the eastern edge of the county, the Kawkawlin River and its tributaries in southwestern and central parts, and the Pinconning and Saganing Rivers in the northern part of the county.

The largest inland body of water in the county is the shallow marsh and lagoon in the Tobico Marsh State Game Area. Important to wildlife and recreation are many small ponds that formed from borrow pits near highway overpasses and interchanges and in areas where sand has been commercially mined.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After classifying and naming the soils, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Descriptions of soil associations

1. Tappan association

Nearly level, poorly drained soils that formed in loamy material; on till plains modified by lake water

This soil association makes up about 8 percent of the county. Tappan soils make up about 88 percent of the association, and soils of minor extent make up the rest.

In most places, Tappan soils are in broad, flat depressions. They have a high available water capacity. Runoff is slow. These soils have a seasonal high water table and are subject to frequent ponding.

Tappan soils have a surface layer that is very dark gray calcareous loam about 10 inches thick. The multicolored calcareous subsoil, which is about 19 inches thick, is friable loam over firm clay loam. The substratum, to a depth of about 60 inches, is dominantly gray calcareous loam.

Of the minor soils in this association, the somewhat poorly drained Londo soils are the most extensive. Londo soils are slightly higher on the landscape than Tappan soils.

The soils in this association are used mainly for cultivated crops. In some areas they are used as woodland or for pasture and hay. Wetness is the main limitation to use of these soils for farming and for most nonfarm uses. If adequately drained, these soils have good potential for cultivated crops. Because wetness is a severe limitation and is difficult to overcome, the potential for building site development is poor. The potential for pasture and hay crops, woodland use, and habitat for wetland wildlife is good.

2. Londo-Tappan association

Nearly level, somewhat poorly drained and poorly drained soils that formed in loamy material; on till plains modified by lake water

This soil association makes up about 21 percent of the county. Londo soils make up about 42 percent of the association, Tappan soils make up 42 percent, and soils of minor extent make up the rest.

In most places, Londo soils are in slightly higher positions on the landscape than Tappan soils. They are on broad, slightly convex uplands and low knolls and ridges. Tappan soils are in broad, flat depressions and drainageways. Londo soils are somewhat poorly drained, and Tappan soils are poorly drained. Both soils have a high available water capacity and a seasonal high water table.

Londo soils have a surface layer that is very dark grayish brown loam about 7 inches thick. The subsoil is brown, mottled, friable clay loam about 13 inches thick. The substratum, to a depth of about 60 inches, is reddish brown mottled calcareous loam.

Tappan soils have a surface layer that is very dark gray calcareous loam about 10 inches thick. The multicolored calcareous subsoil, which is about 19 inches thick, is friable loam over firm clay loam. The substratum, to a depth of about 60 inches, is dominantly gray calcareous loam.

Of the minor soils in this association, the somewhat poorly drained Poseyville and Wixom soils are the most extensive. These soils are slightly higher on the landscape than Londo and Tappan soils.

The soils in this association are used mainly for cultivated crops. In some areas they are used as woodland or for pasture and hay. Wetness is the main limitation to the use of these soils for farming and for most nonfarm uses. If adequately drained, these soils have good potential for farming. The potential for building site development is poor on Tappan soils and fair on Londo soils. The potential for woodland is good.

3. Tappan-Londo-Poseyville association

Nearly level, somewhat poorly drained and poorly drained soils that formed in loamy and sandy material; on till plains modified by lake water

This soil association makes up about 27 percent of the county. Tappan soils make up about 30 percent of the association, Londo soils 24 percent, and Poseyville soils 20 percent. Soils of minor extent make up the rest.

In most places, Tappan soils are in slightly lower positions on the landscape than Londo and Poseyville soils. They are in broad, flat depressions and in drainageways. Londo and Poseyville soils are on broad, slightly convex uplands and on low knolls and ridges. Tappan soils are poorly drained, and Londo and Poseyville soils are somewhat poorly drained. These soils have a seasonal high water table and a high available water capacity.

Tappan soils have a surface layer that is very dark gray calcareous loam about 10 inches thick. The multicolored calcareous subsoil, which is about 19 inches thick, is friable loam over firm clay loam. The substratum, to a depth of about 60 inches, is dominantly gray calcareous loam.

Londo soils have a surface layer that is very dark grayish brown loam about 7 inches thick. The subsoil is brown, mottled, friable clay loam about 13 inches thick. The substratum, to a depth of about 60 inches, is reddish brown mottled calcareous loam.

Poseyville soils have a surface layer that is very dark grayish brown loamy sand about 7 inches thick. The mottled subsoil, which is about 9 inches thick, is yellowish brown loose sand and dark yellowish brown very friable sandy loam. The substratum is very fine sand and silt loam in the upper 6 inches, and below that, to a depth of about 60 inches, it is loam.

Of the minor soils in this association, the somewhat poorly drained Wixom soils and the poorly drained Bach and Belleville soils are the most extensive. Wixom soils are in positions on the landscape similar to those of Londo and Poseyville soils. Bach and Belleville soils are in positions similar to those of Tappan soils.

The soils in this association are used mainly for cultivated crops. In some areas they are used as woodland or for pasture and hay. Wetness is the main limitation to use of these soils for farming and for most nonfarm uses. If adequately drained, these soils have good potential for farming. They have good potential for woodland. The potential for building site development is good on Poseyville soils, fair on Londo soils, and poor on Tappan soils.

4. Tappan-Belleville association

Nearly level, poorly drained soils that formed in loamy and sandy material; on till plains modified by lake water

This soil association makes up about 15 percent of the county. Tappan soils make up about 55 percent of the association, Belleville soils make up 29 percent, and soils of minor extent make up the rest.

In most places, Tappan and Belleville soils are in similar positions in broad, flat depressions. They have a seasonal high water table and are subject to frequent ponding.

Tappan soils have a surface layer that is very dark gray calcareous loam about 10 inches thick. The multicolored calcareous subsoil, which is about 19 inches thick, is friable loam over firm clay loam. The substratum, to a depth of about 60 inches, is dominantly gray calcareous loam.

Belleville soils have a surface layer that is very dark gray loamy sand about 11 inches thick. The subsoil is grayish brown loose sand about 25 inches thick. The substratum, to a depth of about 60 inches, is multicolored clay loam and loam.

The minor soils in this association are the somewhat poorly drained Pipestone soils and the poorly drained Essexville soils. Pipestone soils are on low knolls and ridges, including the beach ridge along the shore of Saginaw Bay. Essexville soils are in similar positions on the landscape as Tappan and Belleville soils.

The soils in this association are used mainly for farming. In some areas they are used as woodland and for habitat for wetland wildlife. Wetness is the main limitation to use of these soils for farming and for most nonfarm uses. Tappan soils have good potential for pasture and hay crops, woodland, and habitat for wetland wildlife. If adequately drained, Tappan soils have good potential for cultivated crops.

Belleville soils have good potential for pasture and hay. Because of the sandy upper layers, Belleville soils have fair potential for habitat for wetland wildlife and poor potential for woodland use. If adequately drained, Belleville soils have good potential for potatoes and fair potential for other cultivated crops.

5. Wixom-Londo-Poseyville association

Nearly level, somewhat poorly drained soils that formed in loamy and sandy material; on till plains modified by lake water

This soil association makes up about 8 percent of the county. Wixom soils make up about 24 percent of the association, Londo soils 23 percent, and Poseyville soils 13 percent. Soils of minor extent make up the rest.

In most places, Wixom, Londo, and Poseyville soils are in similar positions on the landscape. They are on broad, slightly convex uplands and on low knolls and ridges. They are somewhat poorly drained and have a seasonal high water table.

Wixom soils have a surface layer that is very dark brown loamy sand about 9 inches thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The upper part of the subsoil, which is about 15 inches thick, is multicolored loose sand that has chunks of cemented material. The lower part of the subsoil and the substratum, to a depth of 60 inches, are brown mottled loam.

Londo soils have a surface layer that is very dark grayish brown loam about 7 inches thick. The subsoil is dark brown, mottled, friable clay loam about 13 inches thick. The substratum, to a depth of about 60 inches, is reddish brown, mottled, calcareous loam.

Poseyville soils have a surface layer that is very dark grayish brown loamy sand about 7 inches thick. The mottled subsoil, which is about 9 inches thick, is yellowish brown loose sand and dark yellowish brown very friable sandy loam. The substratum is very fine sand and silt loam in the upper 6 inches, and below that, to a depth of about 60 inches, it is loam.

Of the minor soils in this association, the poorly drained Belleville and Tappan soils are the most extensive. These soils are slightly lower on the landscape than Wixom, Londo, and Poseyville soils.

The soils in this association are used mainly for cultivated crops. In some areas they are used for pasture and hay crops or as woodland. Wetness is the main limitation to the use of these soils for farming and for most nonfarm uses. These soils have good potential for pasture and hay crops. The potential for cultivated crops and woodland use is good on Londo and Poseyville soils and fair on Wixom soils. The potential for building site development is good on Wixom and Poseyville soils and fair on Londo soils. These soils have good potential for habitat for woodland wildlife.

6. Wixom-Londo-Guelph association

Nearly level to moderately sloping, well drained to somewhat poorly drained soils that formed in loamy and sandy material; on moraines

This soil association makes up about 4 percent of the county. Wixom soils make up about 29 percent of the association, Londo soils 23 percent, and Guelph soils 12 percent. Soils of minor extent make up the rest.

In most places, Wixom and Londo soils are on broad, nearly level and gently sloping, slightly convex uplands and on low knolls and ridges. In most places, Guelph soils are on gently and moderately sloping side slopes. Wixom and Londo soils are somewhat poorly drained, and Guelph soils are moderately well drained and well drained.

Wixom soils have a surface layer that is very dark brown loamy sand about 9 inches thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The upper part of the subsoil, which is about 15 inches thick, is multicolored loose sand that has chunks of cemented material. The lower part of the subsoil and the substratum, to a depth of 60 inches, are brown, mottled loam.

Londo soils have a surface layer that is very dark grayish brown fine sandy loam about 7 inches thick. The subsoil, which is about 13 inches thick, is dark brown, mottled, friable clay loam. The substratum, to a depth of about 60 inches, is reddish brown, mottled, calcareous loam.

Guelph soils have a surface layer that is very dark grayish brown sandy loam about 8 inches thick. The subsoil, which is about 14 inches thick, is dark brown clay loam. The substratum, to a depth of about 60 inches, is brown, mottled, calcareous clay loam.

The minor soils in this association are the moderately well drained and well drained Menominee soils and the poorly drained Belleville, Tappan, and Corunna soils. Menominee soils are in positions on the landscape similar to those of Guelph soils. Belleville, Tappan, and Corunna soils are in drainageways.

The soils in this association are used mainly for farming. In a few areas they are used as woodland or wildlife habitat. Wetness is the main limitation to use of Wixom and Londo soils for farming and for most nonfarm uses. Water erosion on exposed side slopes is the main limitation to use of Guelph soils for farming and for most nonfarm uses. These soils have good potential for pasture and hay crops. The potential for building site development is good on Wixom and Guelph soils and fair on Londo soils. These soils have good potential for habitat for openland and woodland wildlife.

7. Wixom-Pipestone-Tappan association

Nearly level, somewhat poorly drained and poorly drained soils that formed in sandy and loamy material; on outwash plains and on till plains modified by lake water

This soil association makes up about 9 percent of the county. Wixom soils make up about 25 percent of the association, Pipestone soils 21 percent, and Tappan soils 18 percent. Soils of minor extent make up the rest.

In most places, Wixom and Pipestone soils are slightly higher on the landscape than Tappan soils. They are on broad, slightly convex uplands and on low knolls and ridges. Tappan soils are in broad, flat depressions and drainageways. Wixom and Pipestone soils are somewhat poorly drained, and Tappan soils are poorly drained. All of these soils have a seasonal high water table.

Wixom soils have a surface layer that is very dark brown loamy sand about 9 inches thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The upper part of the subsoil, which is about 15 inches thick, is multicolored loose sand that has chunks of cemented material. The lower part of the subsoil and the substratum, to a depth of 60 inches, are brown mottled loam.

Pipestone soils have a surface layer that is black fine sand about 4 inches thick. The subsurface layer is light brownish gray fine sand about 4 inches thick. The subsoil and substratum, to the depth of 60 inches, are dominantly brown loose fine sand.

Tappan soils have a surface layer that is very dark gray calcareous loam about 10 inches thick. The multicolored calcareous subsoil, which is about 19 inches thick, is friable loam over firm clay loam. The substratum, to a depth of about 60 inches, is dominantly gray calcareous loam.

Of the minor soils in this association the poorly drained Belleville soils and the somewhat poorly drained Poseyville soils are the most extensive. Belleville soils are in positions on the landscape similar to those of Tappan soils. Poseyville soils are in similar positions on the landscape as those of Wixom and Pipestone soils.

The soils in this association are used mainly for cultivated crops or are idle farmland. In some areas they are used as woodland and wildlife habitat and for pasture and hay. Wetness is the main limitation to use of these soils for farming and for most nonfarm uses. Wixom and Pipestone soils have good potential for building site development and for pasture and hay crops and fair potential for woodland use and cultivated crops. Tappan soils have good potential for farming and woodland use and poor potential for building site development. In some upland areas, the potential is good for habitat for woodland wildlife, and in the lower areas it is good for habitat for wetland wildlife.

8. Pipestone-Tobico-Rousseau association

Nearly level and gently sloping, well drained to poorly drained soils that formed in sandy material; on outwash plains, lake plains, and beaches

This soil association makes up about 8 percent of the county. Pipestone soils make up about 38 percent of the association, Tobico soils 24 percent, and Rousseau soils 12 percent. Soils of minor extent make up the rest.

In most places, Pipestone soils are slightly lower on the landscape than Rousseau soils. They are on broad, slightly convex uplands and on low knolls and ridges. Tobico soils are in depressions and drainageways, and Rousseau soils are on elongated knolls and ridges. Pipestone soils are somewhat poorly drained, Tobico soils are poorly drained, and Rousseau soils are moderately well drained and well drained. These soils have a sandy profile and have a low available water capacity.

Pipestone soils have a surface layer that is black fine sand about 4 inches thick. The subsurface layer is light brownish gray fine sand about 4 inches thick. The subsoil and substratum, to the depth of 60 inches, are dominantly brown loose fine sand.

Tobico soils have a surface layer that is very dark gray fine sand about 8 inches thick. The subsoil is brown, mottled, loose fine sand about 30 inches thick. The substratum, to a depth of about 60 inches, is grayish brown fine sand.

Rousseau soils have a surface layer that is black fine sand about 4 inches thick. The subsurface layer is grayish brown fine sand about 2 inches thick. The subsoil and substratum, to a depth of 60 inches, are multicolored loose fine sand.

Of the minor soils in this association, the poorly drained Belleville soils are the most extensive. Belleville soils are in similar positions on the landscape as Tobico soils.

The soils in this association are used mainly for woodland or are idle farmland. In some areas they are used for corn, pasture and hay, or wildlife habitat. Wetness is the main limitation to use of Pipestone and Tobico soils for farming and for most nonfarm uses. Droughtiness is the main limitation to use of the Rousseau soils for farming. Rousseau soils have slight limitations for building site development. The potential for building site development is good on Pipestone and Rousseau soils and poor on Tobico soils. All of these soils have good potential for pasture and hay crops and fair potential for cultivated crops. The potential for woodland use is good on Rousseau soils, fair on Pipestone soils, and poor on Tobico soils. Because these soils are sandy and have a low available water capacity, they have fair or poor potential for wildlife habitat.

Broad land use considerations

Less than 3 percent of the land in Bay County is urban or built-up land, but many residential sites are scattered throughout the county. The general soil map is most helpful in general planning of urban development. It cannot be used, however, to select a specific site for a building. The data about specific soils in this survey area can be helpful in planning land use patterns. In general, the soils in Bay County that have good potential for cultivated crops have poor potential for urban development.

Areas where the soils are not favorable for building site development are extensive in Bay County. Wet soils, for example, have severe limitations for building site development and for sanitary facilities. The Tappan association and the Tappan-Belleville association include soils that have a water table at a depth of less than 1 foot in winter and spring. Wetness and frequent ponding on these soils are severe problems that are difficult and costly to overcome.

There are few areas in Bay County that can be used for building site development at low cost. The least costly areas to develop are in soil associations 7 and 8. The soils in those associations have a seasonal high water table, but wetness is not a major problem on some of the soils, mainly the well drained and moderately well drained Rousseau soils and the somewhat poorly drained Pipestone and Wixom soils.

In most areas of the county the soils have good potential for farming. Those soils, mainly the Tappan and Londo soils, are in soil associations 1 through 6. Wetness is the main limitation of the soils for farming and for most nonfarm uses. If the soils are properly drained, this limitation can be reduced.

The Belleville soils and the Essexville soils in the Tappan-Belleville association are uniquely suited to potatoes. These soils must be artificially drained and protected from ponding. Because the available water capacity is moderate, irrigation is used in many areas.

The soils in the Tappan-Belleville association are also uniquely suited to use as habitat for wetland wildlife because they have a high water table and are adjacent to Saginaw Bay (fig. 1).

Figure 1.—Belleville loamy sand, ponded, is well suited to habitat for wetland wildlife.

In associations 2, 3, 5, 6, 7, and 8, the soils in the lower, wetter, undrained areas are mostly wooded or brushy and some are in wetland grasses, reeds, and sedges. These soils, along with the better drained soils in woodland and idle farmland, provide habitat for many important species of wildlife.

The soils in most of the associations in the county have good or fair potential for woodland use. Commercially valuable trees are rare on many of the soils because of wetness and previous management practices. The wetness results in slow growth, low survival, and poor regeneration of seedlings. The better drained soils in associations 5 through 8 can produce trees that are suitable for pulp and low grade lumber.

The soils in all of the associations have only fair or poor potential for recreation because they are too wet or too sandy. The soils in the lower, wetter areas have a high water table and are subject to frequent ponding (fig. 2). The sandy soils have low fertility and may become droughty. Vegetation on these soils may die out quickly under intensive foot or vehicle traffic. Bare areas on sandy soils are subject to soil blowing.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and

Figure 2.—The Pipestone-Tobico-Rousseau association is poorly suited to recreation because the Tobico soils are subject to frequent ponding.

a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series.* Except for allowable differences in texture of the surface layer or of the underlying 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 in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Belleville loamy sand, ponded, is a phase within the Belleville series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Tappan-Poseyville complex, 0 to 3 percent slopes, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Dumps is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions

12—Corunna-Tappan sandy loams. These are nearly level, poorly drained soils in broad, flat depressions and drainageways. They are subject to frequent ponding. Areas of these soils are irregular in shape and range from 5 to 40 acres in size. Corunna soils make up 40 to 60 percent of the unit and Tappan soils, 20 to 40 percent. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the Corunna soil has a surface layer that is very dark gray sandy loam about 10 inches thick. The subsoil, which is about 19 inches thick, is dark grayish brown friable sandy loam. The substratum, to a depth of 29 inches, is multicolored calcareous clay loam and loam.

Typically, the Tappan soil has a surface layer that is very dark gray calcareous sandy loam about 10 inches thick. The multicolored calcareous subsoil, which is about 19 inches thick, is friable loam over firm clay loam. The substratum, to a depth of about 60 inches, is dominantly gray calcareous loam. In some places, the depth to effervescent material ranges to 40 inches.

Included with these soils in mapping are small areas of the poorly drained Belleville soil in similar positions on the landscape. The Belleville soil has a moderate available water capacity and makes up 10 to 15 percent of the map unit. Also included in mapping are small areas of the somewhat poorly drained Wixom soil in slightly higher positions on the landscape. In some of the mapped areas, Wixom soil makes up about 5 percent of the unit.

Permeability in the Corunna soil is moderate in the subsoil and moderately slow in the substratum. Permeability in the Tappan soil is moderate or moderately slow in the subsoil and slow in the substratum. The available water capacity of both soils is high. Runoff is very slow or ponded on the Corunna soil and slow to ponded on the Tappan soil. In these soils, from November to May, the water table is at a depth of 1 foot or less.

In most areas these soils are used for crops. A few areas are used for pasture or as woodland. These soils have good potential for use as cropland and habitat for wetland wildlife and for pasture and hay crops. The Tappan soil has good potential for use as woodland and the Corunna soil has fair potential. They have poor potential for sanitary facilities and building site development.

If these soils are cultivated, removing excess water is the major management concern. In some areas providing flood protection and adequate drainage outlets is a major management concern. Artificial drainage is needed for optimum crop yields. Dikes help prevent flooding, and lift pumps can be used to help provide adequate drainage. Because of its calcareous surface layer, Tappan soil may be deficient in manganese, boron, and zinc.

If these soils are used for pasture and hay, excess water is the major management concern. Grazing should be restricted during wet periods to reduce compaction of the surface layer. Artificial drainage helps remove excess water and increase crop yields. Pasture plants that tolerate wetness should be used.

If these soils are used for trees, restrictions on the use of equipment and seedling mortality are major management concerns. Windthrow is a major hazard. The use of equipment in planting, tending, and harvesting trees is restricted during wet periods. Because of wetness, the expected seedling loss is high, and trees may blow down during storms.

These soils have severe limitations for building site development and for sanitary facilities. If they are used for building site development they should be artificially drained by surface ditches or tile drainage. Buildings with basements should not be constructed because of the high water table. If possible, sanitary facilities on these soils should be connected to commercial sewers and treatment facilities. The upper layer of these soils should be replaced or covered with a suitable base material if local roads and streets are to function properly. Because it is better drained, the included Wixom soil is better suited to building site development than Corunna-Tappan sandy loams.

Capability subclass IIw; Michigan soil management groups 3/2c and 2.5c-c.

13—Belleville loamy sand. This is a nearly level, poorly drained soil in broad, flat areas, small depressions, and drainageways. It is subject to frequent ponding. Areas of this soil are irregular in shape, and most range from 3 to 200 acres in size.

Typically, the surface layer is very dark gray loamy sand about 11 inches thick. The subsoil is grayish brown loose sand about 25 inches thick. The substratum, to a depth of about 60 inches, is multicolored clay loam and loam. In some places, the surface layer is less than 10 inches thick, and the depth to the loamy substratum is greater than 40 inches. Also in some areas, effervescent material is above a depth of 20 inches.

Included in mapping are small areas of poorly drained Tappan soil in similar positions on the landscape. The Tappan soil has a high available water capacity. It makes up 5 to 10 percent of the map unit. Also included in mapping are small areas of somewhat poorly drained Wixom soil in slightly higher positions on the landscape. This soil makes up about 5 percent of the unit.

Permeability is rapid in the sandy upper part of the soil and moderately slow in the loamy lower part. The available water capacity is moderate. Runoff is very slow or ponded. From March to May, the water table is at a depth of 1 foot or less.

Most areas of this soil are farmed. A few areas are used as woodland. This soil has good potential for pasture and hay crops and for potatoes. It has fair potential for other cash crops grown in the county. It has poor potential for woodland use, for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, providing adequate drainage outlets and flood protection, controlling soil blowing, and maintaining a high content of organic matter are the major concerns of management. Artificial drainage is necessary to remove excess water. In many areas, dikes are needed to prevent flooding, and lift pumps are needed to provide drainage. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing. Additions of crop residue, barnyard manure, and green manure crops are needed to maintain the organic matter content.

If this soil is used for pasture and hay, excess water is the major concern of management. Artificial drainage is needed to remove excess moisture. Grazing should be restricted during wet periods. Pasture plants that tolerate wetness should be used.

If this soil is used for trees, windthrow is a major hazard. Equipment limitations and seedling mortality are major concerns of management. Because of wetness, expected loss of planted seedlings is high. The use of equipment in planting, tending, and harvesting trees is restricted in wet periods.

This soil has severe limitations for building site development and for sanitary facilities (fig. 3). If it is used for these purposes, it should be artificially drained by surface ditches and tile. Buildings with basements should not be constructed because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. Adding a blanket or restrictive layer of impervious material can prevent seepage from sewage lagoons. The upper layer of the soil should be covered with a suitable base material if local roads and streets are to function properly. Because it is better drained, the included Wixom soil is better suited to building site development than this Belleville soil.

Capability subclass IIIw; Michigan soil management group 4/2c.

16—Essexville loamy sand. This is a nearly level, poorly drained soil in broad, flat depressions and drainageways. It is subject to frequent ponding. Areas of this soil are irregular in shape and range from 3 to 400 acres in size.

Typically, the surface layer is black calcareous loamy sand about 11 inches thick. The subsoil and upper substratum, which are about 15 inches thick, are multicolored loose calcareous sand. The lower substratum, to a depth of about 60 inches, is dominantly gray calcareous loam. In some places, the surface layer is less than 10 inches thick, the depth to effervescent material is more than 10 inches, and the depth to the loamy substratum is less than 18 inches.

Included with this soil in mapping are small areas of the poorly drained Tappan soil in similar positions on the landscape. Tappan soil has a high available water capacity. Also included with this soil in mapping is the somewhat poorly drained Wixom soil in slightly higher positions on the landscape. Each of these soils makes up 5 to 10 percent of this map unit.

Permeability is rapid in the sandy upper part of the soil and moderately slow in the loamy lower part. The available water capacity is moderate. Runoff is very slow or ponded. From November to May, the water table is at a depth of 1 foot or less.

In most areas, this soil is farmed. It has good potential for potatoes and fair potential for other cash crops grown in the county. It has poor potential for woodland use, for sanitary facilities, and for building site development.

If this soil is cultivated, removing excess water, controlling soil blowing, maintaining a high organic matter content, and in some areas, providing adequate drainage outlets and flood protection are major concerns of management. Artificial drainage is needed to remove excess water. Because cutbanks cave in, open ditches are difficult to maintain, and tile is difficult to install. Tile lines should be protected with a suitable material so that they

Figure 3.—Belleville loamy sand needs to be drained by surface ditches or tile if used for building site development.

will not fill with fine sand. In some areas, dikes are needed to prevent flooding, and lift pumps are needed to provide drainage. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing. Additions of crop residue, barnyard manure, and green manure crops are needed to maintain the content of organic matter. Because of its calcareous surface layer, Essexville soil may be deficient in manganese, boron, and zinc.

If this soil is used for trees, seedling mortality and windthrow are major hazards. Equipment limitations are a major management concern. Because of wetness, expected seedling loss is high. Trees may blow down during storms. The use of heavy equipment in planting, tending, and harvesting trees is restricted in wet periods.

This soil has severe limitations for building site development and for sanitary facilities. If this soil is used for these purposes it should be artificially drained by surface ditches and tile. Buildings with basements should not be constructed because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. Seepage from sewage lagoons can be prevented by adding a blanket or restrictive layer of impervious material. Because it is better drained, the included Wixom soil is better suited to building site development than this Essexville soil.

Capability subclass IIIw; Michigan soil management group 4/2c-c.

17A—Wixom loamy sand, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on broad, slightly convex uplands and on low knolls and ridges. Areas of this soil are irregular in shape and range from 3 to 320 acres in size.

Typically, the surface layer is very dark brown loamy sand about 9 inches thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The upper part of the subsoil, which is about 15 inches thick, is multicolored loose sand that has chunks of cemented material. The lower part of the subsoil and the substratum, to a depth of 60 inches, is brown mottled loam. In some places, the depth to the loamy substratum is more than 40 inches.

Included in mapping are small areas of the somewhat poorly drained Londo soil in similar positions on the landscape. This soil has a high available water capacity; it makes up 5 to 10 percent of the map unit. Also included in mapping are small areas of poorly drained Tappan and Belleville soils. These soils are in slightly lower positions on the landscape; in some mapped areas they make up about 5 percent of the unit.

Permeability is rapid in the sandy upper part of the soil and moderately slow in the loamy lower part. The available water capacity is moderate. Runoff is slow. From November to June, the water table is at a depth of 1 to 2 feet.

Most areas of this soil are farmed. A few areas are woodland. This soil has good potential for pasture and hay crops, and as habitat for woodland wildlife. It has fair potential for cropland, for woodland use, and for building site development.

If this soil is cultivated, removing excess water in wet periods, controlling soil blowing, maintaining a high organic matter content, and conserving moisture in dry periods are the major concerns of management. Artificial drainage should be installed to remove excess water. Because cutbanks cave in, open ditches are difficult to maintain, and tile is difficult to install. Tile lines should be protected with a suitable material so that they will not fill with fine sand. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing, and crop residue conserves moisture. The content of organic matter can be maintained by frequent additions of crop residue, barnyard manure, and green manure.

If this soil is used for pasture and hay, excess water in wet periods is the major concern of management (fig. 4). Droughtiness in dry periods is a major hazard. Artificial drainage is needed to remove excess water. Grazing should be restricted in wet periods. Growth is reduced in dry periods.

If this soil is used for trees, seedling mortality is the major problem. Expected seedling loss is high in spring when the soil is wet and in summer when the soil is dry.

This soil has severe limitations for building site development and for sanitary facilities. If it is used for these purposes, it should be artificially drained by surface ditches and tile. Buildings with basements should not be constructed because of the high water table. If possible,

Figure 4.—The Wixom soil has good potential for pasture, but grazing should be restricted in spring when wetness is a problem.

sanitary facilities should be connected to commercial sewers and treatment facilities. Seepage from sewage lagoons can be prevented by adding a blanket or restrictive layer of impervious material. The upper layer of the soil should be covered with a suitable base material if local roads and streets are to function properly.

Capability subclass IIIw; Michigan soil management group 4/2b.

23—Tappan loam. This is a nearly level, poorly drained soil in broad, flat depressions and drainageways. It is subject to frequent ponding. Areas of this soil are irregular in shape and range from 3 to 2,000 acres in size.

Typically, the surface layer is very dark gray calcareous loam about 10 inches thick. The multicolored calcareous subsoil, about 19 inches thick, is friable loam over firm clay loam. The substratum, to a depth of about 60 inches, is dominantly gray calcareous loam. In some places, the depth to effervescent material ranges to 40 inches. Also, in some places, the surface layer is lighter in color, and the solum has greater amounts of sand, very fine sand, and silt loam.

Included with this soil in mapping are small areas of the poorly drained Belleville soil in similar positions on the landscape. The Belleville soil has a moderate available water capacity. In some of the mapped areas, it makes up about 5 percent of the map unit. Also included are small areas of the somewhat poorly drained Londo and Poseyville soils in slightly higher positions on the landscape. These soils make up 10 to 15 percent of the unit.

Permeability is moderate or moderately slow in the subsoil and slow in the substratum. The available water capacity is high. Runoff is slow or ponded. From November to May, the water table is at a depth of 1 foot or less.

Most areas of this soil are used for crops. A few areas are used for pasture or as woodland. This soil has good potential for use as cropland, woodland, and habitat for wetland wildlife and for pasture and hay crops. It has poor potential for sanitary facilities and building site development.

If this soil is cultivated, removing excess water, maintaining good soil tilth, and, in some areas, providing adequate drainage outlets and providing flood protection are the major concerns of management (fig. 5). Artificial drainage is needed for optimum crop yields. Good soil tilth can be maintained by tilling within the proper range of moisture content, by using minimum tillage, and by incorporating crop residue into the plow layer. Dikes help prevent flooding, and lift pumps can be used to help provide adequate drainage. Because the surface layer is calcareous, this soil may be deficient in manganese, boron, and zinc.

If this soil is used for pasture and hay, removing excess water is the main concern of management. Grazing should be restricted in wet periods to reduce compaction of the surface layer. Artificial drainage helps remove excess water and thereby increases yields. Pasture plants that tolerate wetness should be used.

If this soil is used for trees, the use of equipment in planting, tending, and harvesting trees is restricted during wet periods. Seedling mortality and windthrow are major hazards. Because of wetness, the expected seedling loss is high, and trees may blow down during storms.

This soil has severe limitations for building site development and for sanitary facilities. If it is used for these purposes, it should be artificially drained by surface ditches or a tile drainage system. Buildings with basements should not be constructed because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. The upper layer of the soil should be replaced or covered with a suitable base material if local roads and streets are to function properly. Because they are better drained, the included Londo and Poseyville soils are better suited to most building site development than Tappan loam.

Capability subclass IIw; Michigan soil management group 2.5c-c.

25A—Pipestone fine sand, loamy substratum, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on broad, slightly convex uplands and on low knolls and ridges. Areas of this soil are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is black fine sand about 9 inches thick. The subsoil and the upper part of the substratum, which are about 46 inches thick, are multicolored loose fine sand. The lower part of the substratum, to a depth of about 60 inches, is brown mottled calcareous loam. In some places, the depth to the loamy substratum is less than 40 inches or more than 60 inches.

Included with this soil in mapping are small areas of moderately well drained or well drained Rousseau soils in higher positions on the landscape. Rousseau soils make up 5 to 10 percent of the map unit. Also included in mapping are small areas of poorly drained Belleville and Tobico soils in slightly lower positions on the landscape. In some mapped areas, Belleville and Tobico soils make up about 5 percent of the unit.

Permeability is rapid in the sandy upper part of the soil and moderately slow or slow in the loamy lower part. The available water capacity is low. Runoff is slow or very slow. From November to May, the water table is at a depth of 6 inches to 1 1/2 feet.

Most areas of this soil are woodland or idle farmland. A few areas are used for crops or pasture. This soil has good potential for pasture and hay. It has fair potential

Figure 5.—Tappan loam is subject to frequent ponding.

for building site development and use as cropland and woodland.

If this soil is cultivated, removing excess water in wet periods, controlling soil blowing, maintaining a high content of organic matter, and conserving moisture in dry periods are major management concerns. Artificial drainage is needed to remove excess water. Because cutbanks cave in, open ditches are difficult to maintain, and tile is difficult to install. Tile lines should be protected with a suitable material so that they will not fill with fine sand. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing, and crop residue conserves soil moisture. The content of organic matter can be maintained by frequent additions of crop residue, barnyard manure, and green manure.

If this soil is used for pasture and hay, excess water in wet periods is the major concern of management and droughtiness in dry periods is a major hazard. Artificial drainage is needed to remove excess water. Grazing should be restricted in wet periods. Growth is reduced in dry periods.

If this soil is used for trees, seedling mortality generally is high in spring when the soil is wet and in summer when the soil is dry.

This soil has severe limitations for building site development and for sanitary facilities. If this soil is used for these purposes, it should be artificially drained by surface ditches and tile. Buildings with basements should not be constructed because of the high water table. Sanitary facilities should be connected to commercial sewers and treatment facilities. Seepage from sewage lagoons can be prevented by adding a blanket or restrictive layer of impervious material. Removing excess water, constructing retaining walls, and maintaining proper slope can control the caving of cutbanks. The included Rousseau soil is better suited to building site development than the Pipestone soil because it is better drained.

Capability subclass IIIw; Michigan soil management group 5/2b.

31—Sloan loam. This is a nearly level, very poorly drained soil on flood plains, in abandoned streambeds, and in drainageways. It is subject to frequent flooding from stream overflow. Areas of this soil are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is black calcareous loam about 11 inches thick. The subsoil and substratum, to a depth of 60 inches, are dominantly gray calcareous silty clay loam and silt loam. In some places, the surface layer is mucky silt loam or muck. In some places, the subsoil is dominantly sandy loam and is brighter in color.

Permeability is moderate or moderately slow. The available water capacity is high. Runoff is very slow or ponded. From November to June, the water table is at a depth of 1 foot or less.

Most areas of this soil are woodland or are in wetland vegetation. A few areas are used for crops or pasture. This soil has good potential for use as woodland and as habitat for wetland wildlife. It has poor potential for cultivated crops, pasture and hay, sanitary facilities, and building site development.

Cultivated crops commonly are not grown on this soil because the soil is subject to frequent flooding. Compaction of the surface layer, which is caused by grazing when the soil is wet, is a major concern of management. Artificial drainage is needed for optimum plant growth. Grazing should be restricted in periods of wetness and flooding. Pasture plants that tolerate wetness should be used.

If this soil is used for trees, seedling mortality and windthrow are major hazards. Restrictions on the use of equipment is a major concern of management. This soil may be flooded frequently. It is wet throughout much of the year. Because of the wetness, trees may blow down during a storm and many plant seedlings can be lost. The use of heavy equipment in planting, tending, and harvesting trees should be restricted.

This soil has severe limitations for building site development and for sanitary facilities. Generally, it is not economically feasible or practical to use this soil for site development.

Capability subclass Vw; Michigan soil management group L-2c.

35A—Pipestone fine sand, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on broad, slightly convex uplands and on low knolls and ridges. Areas of this soil are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is black fine sand about 4 inches thick. The subsurface layer is light brownish gray fine sand about 4 inches thick. The subsoil and substratum, to a depth of 60 inches, are dominantly brown loose fine sand. In some places, loamy material is above a depth of 60 inches.

Included with this soil in mapping are small areas of moderately well drained or well drained Rousseau soils in slightly higher positions on the landscape and small areas of poorly drained Belleville and Tobico soils in slightly lower positions on the landscape. The included soils make up 10 to 20 percent of the map unit.

Permeability is rapid, and the available water capacity is low. Runoff is slow or very slow. From October to June, the water table is at a depth of 6 inches to 1 1/2 feet.

Most areas of this soil are woodland or idle farmland. A few areas are used for crops or pasture. This soil has good potential for pasture and hay crops. It has fair potential for use as cropland and woodland and building site development.

If this soil is cultivated, removing excess water in wet periods, controlling soil blowing, maintaining a high content of organic matter, and conserving moisture in dry periods are the major concerns of management. Artificial drainage is needed to remove excess water. Because cutbanks cave in, open ditches are difficult to maintain, and tile is difficult to install. Tile lines should be protected with a suitable material so that they will not fill with fine sand. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing, and crop residue conserves soil moisture. The content of organic matter can be maintained by frequent additions of crop residue, barnyard manure, and green manure.

If this soil is used for pasture and hay, excess water in wet periods is the major management concern. Droughtiness in dry periods is a major hazard. Artificial drainage is needed to remove excess water. Grazing should be restricted in wet periods. Growth is reduced in dry periods.

If this soil is used for trees, seedling mortality is the main hazard. Expected seedling loss is high in spring when the soil is wet and in summer when the soil is dry (fig. 6).

This soil has severe limitations for building site development and for sanitary facilities. If this soil is used for these purposes, it should be artificially drained by surface ditches and tile. Buildings with basements should not be constructed because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. Seepage from sewage lagoons can be prevented by adding a blanket or restrictive layer of impervious material. Removing excess water, constructing retaining walls, and maintaining proper slope can control the caving of cutbanks. Because it is better drained, the included Rousseau soil is better suited to most building site development than Pipestone soil.

Figure 6.—The Pipestone soil has fair potential for trees. Seedling mortality is the main hazard.

Capability subclass IVw; Michigan soil management group 5b.

37B—Rousseau fine sand, 0 to 6 percent slopes. This is a nearly level and gently sloping, moderately well drained or well drained soil on knolls and ridges. Areas of this soil are long and narrow and dominantly range from 3 to 40 acres in size.

Typically, the surface layer is black fine sand about 4 inches thick. The subsurface layer is grayish brown fine sand about 2 inches thick. The subsoil and substratum, to a depth of 60 inches, are multicolored loose fine sand. In some places, thin strata of very fine sand and silt loam are in the substratum.

Included in mapping and making up 5 to 15 percent of the map unit are small areas of somewhat poorly drained Pipestone and Pipestone loamy substratum soils in slightly lower positions on the landscape.

Permeability is rapid, and the available water capacity is low. Runoff is slow or very slow. From March to May, the water table is at a depth of 2 1/2 feet to 6 feet.

Most areas of this soil are woodland or idle farmland. A few areas are used for hay and pasture and corn. This soil has good potential for hay and pasture, for woodland use, and for building site development. It has fair potential for cultivated crops.

If this soil is cultivated, controlling soil blowing, conserving soil moisture in dry periods, and maintaining a high content of organic matter are major management concerns (fig. 7). Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing, and crop residue conserves soil moisture. The content of organic matter can be maintained by frequent additions of crop residue, barnyard manure, and green manure.

If this soil is used for pasture and hay, droughtiness is a major hazard. Growth is reduced in dry periods. Deep rooted plants that resist drought should be used.

If this soil is used for trees, seedling mortality is a moderate hazard. Some seedling loss can be expected in the dry summer months.

This soil has slight limitations for building site development. Because of the high water table, buildings with basements should not be constructed. This soil has severe limitations for sewage lagoons because of seepage and for shallow excavations because cutbanks cave-in. Seepage can be prevented by adding a blanket or restrictive layer of impervious material. The cave-in of cutbanks can be controlled by constructing retaining walls and maintaining a proper slope grade. Lawns need a cover of loam topsoil and should be watered frequently. Cleared areas around construction sites should be kept to a minimum size and should be protected from soil blowing by mulch, asphalt spray, netting, grass seeding or sodding and fertilization, planted clumps of grass, windbreaks, or snow fences.

Capability subclass IIIs; Michigan soil management group 5a.

43A—Londo loam, 0 to 1 percent slopes. This is a nearly level, somewhat poorly drained soil on broad, slightly convex uplands and low knolls and ridges. Areas

Figure 7.—If the Rousseau soil is cultivated, soil blowing, droughtiness, and low fertility are the main problems. In the light colored areas, plowing has mixed material from the subsurface layer with that of the surface layer.

of this soil are irregular in shape and range from 3 to 320 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is brown, mottled, friable clay loam about 10 inches thick. The substratum, to a depth of about 60 inches, is reddish brown, mottled, calcareous loam. In some places, moderately well drained areas are on knolls and ridges. Also in some places, the surface layer and the subsoil are sandy.

Included with this soil in mapping are small areas of the poorly drained Tappan soil in slightly lower positions on the landscape. The Tappan soil makes up 10 to 20 percent of the map unit.

Permeability is moderate or moderately slow, and the available water capacity is high. Runoff is slow. From November to May, the water table is at a depth of 1 to 2 feet.

Most areas of this soil are used for crops. This soil has good potential for use as cropland, woodland, and habitat for openland and woodland wildlife and for pasture and hay crops. It has fair potential for building site development.

If this soil is cultivated, removing excess water in wet periods and maintaining good soil tilth are the major concerns of management. Artificial drainage is needed for optimum crop yields. Good soil tilth can be maintained by tilling within the proper range of moisture content, by using minimum tillage, and by incorporating crop residue into the plow layer.

If this soil is used for pasture and hay, excess water in wet periods and a compacted surface layer, which is caused by grazing when the soil is wet, are the major concerns of management. Artificial drainage is needed for optimum plant growth. Grazing should be restricted during wet periods.

If this soil is used for trees, the use of heavy equipment in planting, tending, and harvesting trees is restricted in wet periods.

This soil has severe limitations for building site development and for sanitary facilities. If it is used for these purposes it should be artificially drained by surface ditches or a tile drainage system. Buildings with basements should not be constructed because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. The upper layer of the soil should be replaced or covered with a suitable base material if local roads and streets are to function properly.

Capability subclass IIw; Michigan soil management group 2.5b.

49A—Londo-Poseyville complex, 0 to 3 percent slopes. This complex consists of somewhat poorly drained soils on broad, slightly convex uplands and low knolls and ridges. Areas of this unit are irregular in shape and range in size from 10 to 640 or more acres. The Londo soil makes up 40 to 60 percent of the unit and the Poseyville soil 30 to 40 percent. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the Londo soil has a surface layer that is very dark grayish brown loam about 9 inches thick. The subsoil is brown, mottled, friable clay loam about 10 inches thick. The substratum, to a depth of about 60 inches, is reddish brown, mottled, calcareous loam.

Typically, the Poseyville soil has a surface layer that is very dark grayish brown loamy sand about 7 inches thick. The mottled subsoil, which is about 9 inches thick, is yellowish brown loose sand and dark yellowish brown very friable sandy loam. The multicolored calcareous substratum is very fine sand and silt loam in the upper 6 inches. Below that, to a depth of about 60 inches, it is loam.

Included with these soils in mapping are small areas of Wixom soil in similar positions on the landscape; the Wixom soil has a moderate available water capacity. Also included are small areas of the poorly drained Tappan soil in slightly lower positions on the landscape. Individually, these soils make up 5 to 20 percent of a mapped area, but together they make up less than 25 percent of the map unit.

Permeability in the Londo soil is moderate or moderately slow. Permeability in the Poseyville soil is rapid in the sandy upper part and moderate or moderately slow in the loamy lower part. The available water capacity of both soils is high. Runoff on the Londo soil is slow or medium, and on the Poseyville soil it is slow. From November to May, both soils have a water table at a depth of 1 to 2 feet.

Most areas of these soils are used for crops. The soils have good potential for use as cropland and woodland and habitat for woodland wildlife and for pasture and hay crops. The Poseyville soil has good potential for building site development, and the Londo soil has fair potential.

If these soils are cultivated, removing excess water is the major concern of management. Maintaining good soil tilth is a mangement concern on the Londo soil. Controlling soil blowing, maintaining a high content of organic matter, and conserving soil moisture in dry periods are management concerns on the Poseyville soil. Artificial drainage is needed for optimum crop yields. Good soil tilth can be maintained on the Londo soil by tilling within the proper range of moisture content, using minimum tillage, and incorporating crop residue into the plow layer. On the Poseyville soil, minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing, and crop residue helps conserve soil moisture. The content of organic matter in the Poseyville soil can be maintained by frequent additions of crop residue, barnyard manure, and green manure.

If these soils are used for pasture and hay, excess water during wet periods is the major concern of management. Compaction of the surface layer, which is caused by grazing when the soil is wet, is a management concern on the Londo soil. Artificial drainage is needed for optimum plant growth. Grazing should be restricted during wet periods.

If these soils are used for trees, the use of heavy equipment in planting, tending, and harvesting trees should be restricted during wet periods.

These soils have severe limitations for building site development and for sanitary facilities. If these soils are used for these purposes, they should be artificially drained by surface ditches or tile. Buildings with basements should not be constructed because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. The upper layer of these soils should be replaced or covered with a suitable base material if local roads and streets are to function properly.

Capability subclass IIw; Michigan soil management groups 2.5b and 3/2b.

50—Cohoctah loamy fine sand. This is a nearly level, poorly drained or very poorly drained soil on flood plains, in abandoned streambeds and in drainageways. This soil is subject to frequent flooding from stream overflow. Areas of this soil are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is black loamy fine sand about 11 inches thick. The subsurface layer is very dark grayish brown fine sandy loam about 7 inches thick. The substratum, to a depth of 60 inches, is multicolored loamy fine sand and fine sandy loam. In some places, the depth to effervescent material is more than 30 inches. Also in some places, the upper part of the soil is dominantly loam, or very fine sand and silt loam.

Permeability is moderately rapid, and the available water capacity is high. Runoff is very slow or ponded. From September to May, the water table is at a depth of 1 foot or less.

Most areas of this soil are woodland or are in wetland vegetation. A few areas are used for pasture. This soil has good potential for use as woodland and as habitat for wetland wildlife. It has poor potential for cropland, pasture, hay crops, sanitary facilities, and building site development.

Cultivated crops commonly are not grown on this soil because the soil is subject to frequent flooding.

If this soil is used for pasture and hay, excess water is a major management concern. Artificial drainage is needed to remove excess water. Grazing should be restricted in wet periods. Pasture plants that tolerate wetness should be used.

If this soil is used for trees, seedling mortality and windthrow are major hazards. Restrictions on the use of equipment are a major management concern. This soil may be flooded frequently and is wet throughout much of the year. Because of the wetness, trees may blow down during a storm, and many plant seedlings can be lost. The use of heavy equipment for planting, tending, and harvesting trees should be restricted.

This soil has severe limitations for building site development and sanitary facilities. It is generally not economically feasible or practical to use this soil for building sites.

Capability subclass Vw; Michigan soil management group L-2c.

51—Urban land. This map unit consists of nearly level and gently sloping areas covered by streets, parking lots, buildings, and other structures. These soils have been covered or altered in about 85 percent of the areas. Areas of this unit are irregular in shape and range from 15 to 200 acres in size.

Included in mapping are small areas of poorly drained Essexville and Tappan soils, somewhat poorly drained Londo soil, and moderately well drained or well drained Rousseau soil. The included soils make up less than 20 percent of a mapped area, but any one of the included soils can make up as much as 15 percent of an area.

Urban land is mainly built-up areas, which preclude use for other purposes.

Most areas are drained by storm sewers, gutters, drainage tile, or, to a lesser extent, ditches.

The potential for building site development and recreation uses varies greatly. Onsite investigation is necessary to determine the hazards and the degree of limitation for specific uses.

Not assigned to an interpretive group.

52—Urban land-Tappan complex. This complex consists of Urban land and the nearly level, poorly drained Tappan soil in broad, flat depressions and drainageways. The Tappan soil is subject to ponding. The areas are irregular in shape and range from 15 to 550 acres or more in size. Urban land makes up 25 to 80 percent of the unit, and Tappan soil makes up 15 to 50 percent. The areas of Urban land and those of the Tappan soil are so intermingled or so small that it was not practical to separate them in mapping at the scale used.

Urban land is covered by streets, parking lots, buildings, and other structures. Consequently, the soils are not easily identifiable.

Typically, the Tappan soil has a surface layer that is very dark gray calcareous loam about 10 inches thick. The multicolored calcareous subsoil, about 19 inches thick, is friable loam over firm clay loam. The substratum, to a depth of about 60 inches, is dominantly gray calcareous loam. In some places, the depth to effervescent material ranges to 40 inches. In some places, the soil has been radically altered. Some of the low areas have been filled or leveled during construction. Other small areas have been cut, built up, or smoothed.

Included in mapping are small areas of the poorly drained Essexville soil in similar positions on the landscape. This soil has rapid permeability in the upper part. Also included are small areas of somewhat poorly drained Londo and Poseyville soils in slightly higher positions on the landscape. Individually, these included soils make up as much as 10 percent of any mapped area; together they make up less than 20 percent of the map unit.

Permeability is moderate or moderately slow in the subsoil and slow in the substratum. The available water capacity is high. Runoff is slow to ponded. Most areas of this map unit are artificially drained through sewer systems, gutters, drainage tile, and surface ditches. From November to May, the Tappan soil where it is not drained has a water table at a depth of 1 foot or less.

The Tappan soil is used for building sites, lawns and gardens, parks, and open space. It has good potential for lawns, vegetable and flower gardens, and trees and shrubs. It has poor potential for recreation uses, sanitary facilities, and building site development.

If the Tappan soil is used for grasses, flowers, vegetables, trees, and shrubs, excess water is a major problem. It can be removed by artificial drainage. Onsite investigation is needed to determine the best method for a particular area. Perennial plants that tolerate wetness should be used. Soil erosion is a problem if the soil is distributed and left bare for a long time or if it is used as a water course.

The Tappan soil has severe limitations for building site development and for recreation uses. Buildings with basements should not be constructed because of the high water table. When this soil is wet, it is sticky and slippery, and the use of heavy equipment is restricted. The soils need to be artificially drained and protected from flooding. Sanitary facilities should be connected to commercial sewers and treatment facilities. If local roads and streets are to function properly, the upper layer of the Tappan soil should be replaced or covered with a suitable base material.

Where possible, the small areas of the included better drained Londo and Poseyville soils should be used for building sites and for recreation uses. Onsite investigation is needed to properly evaluate and plan the development of specific sites.

Not assigned to an interpretive group.

53A—Urban land-Londo complex, 0 to 1 percent slopes. This complex consists of Urban land and the nearly level, somewhat poorly drained Londo soil on broad, slightly convex uplands and on low knolls and ridges. The areas are irregular in shape and range in size from 15 to 200 acres or more. Urban land makes up 25 to 80 percent of the complex, and Londo soils make up 15 to 50 percent. The areas of Urban land and those of the Londo soil are so intermingled or so small that it was not practical to separate them in mapping at the scale used.

Urban land is covered by streets, parking lots, buildings, and other structures. The soils have been covered or altered to the point that identification is not feasible.

Typically, the Londo soil has a surface layer that is very dark grayish brown loam about 11 inches thick. The subsoil is dark brown mottled friable clay loam about 10 inches thick. The substratum, to a depth of about 60 inches, is reddish brown mottled calcareous loam. In some places, the surface layer and subsoil are sandy, and in other places, the soil has been radically altered. Some of the low areas have been filled or leveled during construction. Other small areas have been cut, built up, or smoothed.

Included in mapping are small areas of poorly drained Tappan soil in slightly lower positions on the landscape. The Tappan soil makes up 10 to 20 percent of the map unit.

Permeability of the Londo soil is moderate or moderately slow. The available water capacity is high. Runoff is slow. Most areas of this map unit are artificially drained through sewer systems, gutters, drainage tile, and surface ditches. From November to May, the Londo soil where it is not drained has a water table at a depth of 1 or 2 feet.

The Londo soil is used for building sites, lawns and gardens, parks, and open space. It has good potential for lawns, vegetable and flower gardens, trees, and shrubs. It has fair potential for recreation uses and for building site development.

If the Londo soil is used for grasses, flowers, vegetables, trees, and shrubs, excess water in wet periods is a major concern. It can be removed by artificial drainage. Onsite investigation is needed to determine the best method of artificial drainage for a particular area.

Londo soil has severe limitations for building site development and moderate limitations for recreation uses. If this soil is used for these purposes, it should be artificially drained by surface ditches or tile. Buildings with basements should not be constructed because of the high water table. Sanitary facilities should be connected to commercial sewers and treatment facilities. If local roads and streets are to function properly, the upper layer of the Londo soil should be replaced or covered with a suitable base material. Onsite investigation is needed to properly evaluate and plan the development of specific sites.

Not assigned to an interpretive group.

54B—Urban land-Rousseau complex, 0 to 6 percent slopes. This complex consists of Urban land and the nearly level and gently sloping, moderately well drained or well drained Rousseau soil. It is on knolls and ridges. The areas are irregular in shape and range in size from 15 to 50 acres or more. Urban land makes up 25 to 80 percent of the complex, and the Rousseau soil makes up 20 to 55 percent. Areas of Urban land and those of the Rousseau soil are so intermingled or so small that it was not practical to separate them in mapping at the scale used.

The Urban land is covered by streets, parking lots, buildings, and other structures. The soils have been covered or altered to the point that identification is not feasible.

Typically, the Rousseau soil has a surface layer that is black fine sand about 4 inches thick. The subsurface layer is grayish brown fine sand about 2 inches thick. The subsoil and substratum, to a depth of 60 inches, are multicolored loose fine sand. In some places, the soil has been radically altered. Some areas have been filled or leveled during construction. Other small areas have been cut or smoothed.

Included in mapping are small areas of somewhat poorly drained Pipestone, Pipestone loamy substratum, and Wixom soils in slightly lower positions on the landscape. These soils make up 10 to 20 percent of the map unit.

Permeability of the Rousseau soil is rapid. The available water capacity is low. Runoff is slow or very slow. Most areas of this map unit are artificially drained through sewer systems and gutters. From March to May, in areas that are not drained, the water table is at a depth of 2 1/2 feet to 6 feet.

The Rousseau soil is used for building sites, lawns and gardens, parks, and open space. It has good potential for trees and shrubs. It has fair potential for lawns and vegetable and flower gardens. It has good potential for building site development and fair potential for most recreation uses.

If the Rousseau soil is used for grasses, flowers, vegetables, and trees and shrubs, conserving soil moisture in dry periods and controlling soil blowing are major problems. Frequent watering and a cover of loam topsoil help conserve moisture. Perennial plants that are deep rooted and drought resistant should be used. If the soil is disturbed and left bare, soil blowing is a problem. To control soil blowing, cleared areas should be kept to a minimum size, and mulches should be used.

The Rousseau soil has slight limitations for building site development. It has severe limitations for onsite waste disposal, sewage lagoons, and shallow excavations. Buildings that have basements should not be constructed on this soil because of the high water table. Seepage from sewage lagoons can be prevented by adding a blanket or restrictive layer of impervious material. Cave-in of cutbanks can be prevented by constructing retaining walls and maintaining a proper slope grade. Lawns need a cover of loam topsoil and should be watered frequently. Cleared areas around construction sites should be kept to a minimum size and should be protected from soil blowing by mulch, asphalt spray, netting, grass seeding or sodding and fertilization, planted clumps of grass, windbreaks, or snow fences.

The Rousseau soil has severe limitations for playgrounds and for paths and trails and moderate limitations for camp areas and picnic areas. If this soil is used for these purposes, the sandy surface should be covered or mixed with a suitable material.

Not assigned to an interpretive group.

55—Aquents, sandy and loamy. This map unit consists of nearly level, poorly drained soil. It is in borrow areas, low areas that have been filled and leveled, and areas along the Saginaw River where dredged material was used as fill (fig. 8). Areas of this unit are irregular in shape and range from 3 to 80 acres in size.

Typically, the profile consists of wet sandy or loamy material that has been moved and greatly altered.

Included in mapping and making up less than 15 percent of the map unit are small areas of various undisturbed soils.

The soil properties of this unit are extremely variable and should be determined by onsite investigation. From November to June, the water table generally is at a

Figure 8.—This area of Aquents is used for recreation.

depth of 6 inches to 2 feet. The soils are subject to frequent ponding.

Most areas are idle. Some areas do not have vegetative cover. Other areas are used for building site development and recreation. The potential for use of these soils varies greatly.

Suitability for use of Aquents as cropland, woodland, and pasture varies greatly. If used for these purposes, onsite investigation is needed to determine the practices necessary to overcome major hazards and management problems.

The potential for building site development and recreation uses varies greatly. Because some of the areas contain water, onsite investigation is necessary to determine suitability, limitations, and proper management for these uses.

Not assigned to an interpretive group.

56—Dumps. This map unit consists of areas that are filled with refuse and trash. Most areas are active landfills and do not have vegetative cover. But in some places, layers of soil material cover the refuse. Most areas are rectangular in shape and range from 5 to 140 acres in size.

Included in mapping, and making up less than 15 percent of the map unit, are small areas of various undisturbed soils.

The properties of this unit are extremely variable and should be determined by onsite investigation.

The potential for building site development and for recreation uses varies greatly. Onsite investigation is necessary to determine suitability, limitations, and proper management for these uses.

Not assigned to an interpretive group.

57A—Poseyville loamy sand, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on broad, slightly convex uplands and on low knolls and ridges. Areas of this unit are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 7 inches thick. The mottled subsoil, about 9 inches thick, is yellowish brown loose sand and dark yellowish brown very friable sandy loam. The multicolored calcareous substratum is very fine sand and silt loam in the upper 6 inches; below that, to a depth of 60 inches, it is loam. In some places, the depth to the loamy substratum is less than 13 inches or more than 24 inches.

Included with this soil in mapping are small areas of the poorly drained Tappan soil in slightly lower positions on the landscape. The Tappan soil makes up 5 to 15 percent of the map unit.

Permeability is rapid in the sandy upper part of the soil and moderate or moderately slow in the loamy lower part. The available water capacity is high. Runoff is slow. From November to May, the water table is at a depth of 1 to 2 feet.

Most areas of this soil are used for crops. A few areas are used for pasture or are in native vegetation, including trees. This soil has good potential for cultivated crops, pasture, and hay and for use as woodland and habitat for woodland wildlife. It has fair potential for building site development.

If this soil is cultivated, removing excess water in wet periods, conserving soil moisture in dry periods, controlling soil blowing, and maintaining a high content of organic matter are the major concerns of management. Artificial drainage is needed to remove the excess water. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, barnyard manure, and green manure are needed to maintain the content of organic matter. Crop residue and zero tillage also help to conserve soil moisture.

If this soil is used for pasture and hay, excess water in wet periods is the major management concern. Artificial drainage is needed to remove the excess water. Grazing should be restricted in wet periods. Growth is reduced in dry periods.

If this soil is used for trees, seedling mortality is the major management concern. Seedling loss can be expected during the dry summer months.

This soil has severe limitations for building site development and for sanitary facilities. If this soil is used for these purposes, it should be artificially drained by surface ditches and tile. Buildings that have basements should not be constructed on this soil because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. Seepage from sewage lagoons can be prevented by adding a blanket or restrictive layer of impervious material.

Capability subclass IIw; Michigan soil management group 3/2b.

58A—Tappan-Poseyville complex, 0 to 3 percent slopes. This map unit consists of a nearly level, poorly drained Tappan soil and a somewhat poorly drained Poseyville soil. The Tappan soil is subject to frequent ponding. It is in broad, flat depressions and drainageways. The Poseyville soil is on broad, slightly convex uplands and on low knolls and ridges. Areas of this unit are irregular in shape and range in size from 10 to 1,000 acres. The Tappan soil makes up 40 to 65 percent of the unit and the Poseyville soil, 20 to 35 percent. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the Tappan soil has a surface layer that is very dark gray calcareous loam about 10 inches thick. The multicolored calcareous subsoil, about 19 inches thick, is friable loam over firm clay loam. The substratum, to a depth of about 60 inches, is dominantly gray calcareous loam. In some places, the depth to effervescent material ranges to 40 inches. Also in some places, the upper part of the profile has a higher proportion of sand.

Typically, the Poseyville soil has a surface layer that is very dark grayish brown loamy sand about 7 inches thick. The mottled subsoil, about 9 inches thick, is yellowish brown loose sand and dark yellowish brown very friable sandy loam. The multicolored calcareous substratum is very fine sand and silt loam in the upper 6 inches and loam to a depth of about 60 inches. In some places, the loamy substratum is at a depth of less than 13 inches.

Permeability is moderate or moderately slow in the subsoil of the Tappan soil and slow in the substratum. It is rapid in the sandy upper part of the Poseyville soil and moderate or moderately slow in the loamy lower part. The available water capacity of both soils is high. Runoff is slow to ponded on the Tappan soil and slow on the Poseyville soil. From November to May, the water table is at a depth of 1 foot or less in the Tappan soil and at a depth of 1 to 2 feet in the Poseyville soil.

In most areas these soils are farmed. They have good potential for use as cropland and woodland, and for pasture and hay. The Tappan soil has poor potential for building site development and the Poseyville soil has fair potential.

If these soils are cultivated, removing excess water during wet periods, controlling soil blowing, maintaining a high organic matter content, and conserving soil moisture during dry periods are the major concerns of management on the Poseyville soil, and removing excess water and maintaining good soil tilth are the major concerns of management on the Tappan soil. Artificial drainage is needed for optimum crop yields. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing. The content of organic matter can be maintained by frequent additions of crop residue, barnyard manure, and green manure. Crop residue helps conserve soil moisture. Good soil tilth can be maintained by tilling within the proper range of moisture content, using minimum tillage, and incorporating crop residue into the plow layer. Because of its calcareous surface layer, the Tappan soil may be deficient in manganese, boron, and zinc.

If these soils are used for pasture and hay, excess water during wet periods is a major concern of management on the Poseyville soil, and excess water and compaction of the surface layer, which is caused by grazing when the soil is wet, are the major concerns of management on the Tappan soil. Artificial drainage is needed for optimum plant growth. Grazing should be restricted during wet periods. Pasture plants that tolerate wetness should be used. Growth is reduced in dry periods.

If these soils are used for trees, restrictions on the use of equipment are major management concerns. Furthermore, seedling mortality and windthrow are major hazards on the Tappan soil. Because of wetness, the expected seedling loss is high, and trees may be blown down during a storm. The use of heavy equipment for planting, tending, and harvesting trees should be restricted during wet periods.

These soils have severe limitations for building site development and for sanitary facilities. If possible, areas of the better drained Poseyville soil should be selected for development. Onsite inspection is essential to properly evaluate and plan the development of specific sites. If these soils are used for building sites, they should be artificially drained by surface ditches and tile. Buildings with basements should not be constructed because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. The upper layer of the soil should be covered with a suitable base material if local roads and streets are to function properly.

Capability subclass IIw; Michigan soil management groups 2.5c-c and 3/2b.

59—Tobico fine sand. This is a nearly level, poorly drained soil in depressions and drainageways. This soil is subject to frequent ponding. Areas of this unit are irregular in shape and range from 3 to more than 100 acres in size.

Typically, the surface layer is very dark gray fine sand about 8 inches thick. The subsoil is brown, mottled loose fine sand about 30 inches thick. The substratum, to a depth of about 60 inches, is grayish brown fine sand. In some places, the surface layer is more than 10 inches thick. In some places, the substratum has strata of gravelly material. Also in some places, loamy material is within a depth of 60 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone soil in slightly higher positions on the landscape. Pipestone soil makes up 5 to 15 percent of the unit.

Permeability is very rapid. The available water capacity is low. Runoff is very slow or ponded. From September to June, this soil has a water table at a depth of 1 foot or less.

In most areas, this soil is used as woodland or is idle farmland. In a few areas, it is used for crops or pasture. This soil has good potential for pasture and hay crops. It has fair potential for cultivated crops and poor potential for woodland, sanitary facilities, and building site development.

If this soil is cultivated, removing excess water, providing flood protection, controlling soil blowing, and maintaining a high content of organic matter are the major concerns of management. Artificial drainage is generally needed to remove excess water. Because cutbanks cave in, open ditches are difficult to maintain, and tile is difficult to install. Tile lines should be protected with a suitable material so that they do not fill with fine sand. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing. Additions of crop residue, barnyard manure, and green manure crops are needed to maintain the organic matter content.

If this soil is used for pasture and hay, excess water is the major management concern. Artificial drainage is needed to remove excess moisture. Grazing should be restricted in wet periods. Pasture plants that tolerate wetness should be used.

If this soil is used for trees, seedling mortality and windthrow are major hazards. Equipment limitations are a major concern. Because of wetness, expected loss of planted seedlings is high, and trees can be blown down during storms. The use of heavy equipment for planting, tending, and harvesting trees is restricted in wet periods.

This soil has severe limitations for building site development and for sanitary facilities. If this soil is used for these purposes, it should be artificially drained using surface ditches and tile. Buildings that have a basement should not be constructed because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. Seepage from lagoons can be prevented by adding a restrictive layer of impervious material. Excess water removal, retaining walls, and properly maintained slopes can prevent the caving in of cutbanks in shallow excavations. Because it is better drained, the included Pipestone soil is better suited to building site development than this Tobico soil.

Capability subclass IIIw; Michigan soil management group 5c.

60—Urban land-Essexville complex. This map unit consists of areas of Urban land and the nearly level, poorly drained Essexville soil in broad, flat depressions and drainageways. Areas of this unit are irregular in shape and range from 20 to 400 acres in size. Urban land makes up 25 to 80 percent of this unit and the Essexville soil, 20 to 55 percent. Urban land and the Essexville soil are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Urban land is covered with streets, parking lots, buildings, and other structures. The soils have been covered or altered to the point that identifying them is not feasible.

Typically, the surface layer of the Essexville soil is black calcareous loamy sand about 11 inches thick. The subsoil and the upper part of the substratum, which are about 15 inches thick, are multicolored, loose calcareous sand. The lower part of the substratum, to a depth of about 60 inches, is dominantly gray calcareous loam. In some places, the depth to effervescent material is more than 10 inches. In some areas, the depth to the loamy substratum is less than 18 inches. In some low areas, the soil has been filled or leveled during construction; in other small areas, it has been cut, built up, or smoothed.

Included in mapping are small areas of the somewhat poorly drained Wixom soil in slightly higher positions on the landscape. In some mapped areas, the Wixom soil makes up 5 percent of the unit.

Permeability of the Essexville soil is rapid in the sandy upper part of the soil and moderately slow in the loamy lower part. The available water capacity is moderate. Runoff is very slow or ponded. Most areas of this map unit have been artificially drained using sewer systems, gutters, drainage tile, and surface ditches. In areas that have not been drained, the water table is at a depth of 1 foot or less from November to May.

The Essexville soil is used for building sites, lawns, gardens, parks, and open space. It has poor potential for recreation uses and building site development.

If the Essexville soil is used for grasses, flowers, vegetables, trees, and shrubs, the excess water needs to be removed. Artificial drainage generally is needed to remove the excess water; onsite investigation is needed to determine the best method of artificial drainage for any particular area. In drained areas, this soil can become droughty during dry periods. Water-tolerant perennial plants should be selected for planting. If the soil is disturbed and left bare for a long period, soil blowing is a hazard.

The Essexville soil has severe limitations to building site development and recreation uses; it needs to be artificially drained and protected from flooding. Buildings that have a basement should not be constructed because of the high water table. Sanitary facilities should be connected to commercial sewers and treatment facilities. If possible, the better drained Wixom soil included in this map unit should be used for building site development and recreation facilities instead of the Essexville soil. Onsite investigation will be needed to evaluate the suitability of specific sites.

This complex is not assigned to an interpretive group.

61—Cohoctah fine sandy loam. This is a nearly level, poorly drained or very poorly drained soil in abandoned streambeds and drainageways. This soil is subject to occasional flooding. Areas of this soil are long and narrow and range from 3 to 160 acres in size.

Typically, the surface layer is black fine sandy loam about 11 inches thick. The mottled, calcareous substratum is grayish brown loamy fine sand about 9 inches thick in the upper part, light brownish gray fine sandy loam about 17 inches thick in the middle part, and light brownish gray loam about 17 inches thick in the lower part. In the substratum there is a buried surface layer of black mucky loam about 7 inches thick.

Included in mapping are small areas of the poorly drained Belleville and Tappan soils in slightly higher positions on the landscape. These soils make up 15 to 20 percent of the map unit.

Permeability is moderately rapid, and the available water capacity is high. Runoff is very slow or ponded.

The water table is at a depth of 1 foot or less from October to May.

In most areas this soil is used for crops. In a few areas, it is used as grassed waterways. This soil has good potential for pasture and hay, for use as woodland, and for the development of habitat for wetland wildlife. It has fair potential for use as cropland and poor potential for sanitary facilities and building site development.

If this soil is cultivated, removing excess water and providing adequate outlets for drainage are the major management concerns. The water table is at or near the surface throughout much of the year, and this soil is subject to occasional flooding. Artificial drainage and lift pumps should be installed to remove excess water. Because the areas of this soil are narrow and irregularly shaped, special management practices may be impractical.

If this soil is used for pasture and hay, the excess water needs to be removed through artificial drainage. Grazing should be restricted in wet periods. Water-tolerant pasture plants should be selected for planting.

If this soil is used for trees, seedling mortality and windthrow are the major hazards. The use of heavy equipment in planting, tending, and harvesting trees is restricted. This soil is subject to occasional flooding and is wet throughout much of the year. Because of the wetness, the loss of seedlings can be heavy, and trees can blow down during storms.

This soil has severe limitations to building site development and sanitary facilities; using these soils for these purposes generally is not economically feasible.

Capability subclass IIIw; Michigan soil management group L-2c.

62A—Sanilac-Bach very fine sandy loams, 0 to 3 percent slopes. This map unit consists of nearly level soils; the Sanilac soil is somewhat poorly drained, and the Bach soil is poorly drained. The Sanilac soil is on slightly convex uplands and on low knolls and ridges. The Bach soil is in depressions and drainageways and is subject to frequent ponding. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

The areas of this map unit are irregular in shape and range from 10 to 80 acres in size. The Sanilac soil makes up 35 to 60 percent of the unit, and the Bach soil makes up 20 to 40 percent.

Typically, the surface layer of the Sanilac soil is very dark grayish brown, calcareous very fine sandy loam about 10 inches thick. The subsoil is yellowish brown and light yellowish brown, very friable, calcareous very fine sand, loamy very fine sand, and silt loam about 32 inches thick. The substratum, to a depth of about 60 inches, is reddish brown, mottled, calcareous, stratified very fine sand, silt loam, and silty clay loam. In places, the surface layer and subsoil are sandy. In some places, the loam and clay loam glacial till is within a depth of 60 inches.

Typically, the surface layer of the Bach soil is very dark gray, calcareous very fine sandy loam about 13 inches thick. The subsoil and the upper part of the substratum are grayish brown, mottled, friable, calcareous, stratified very fine sand and silt loam about 37 inches thick. The lower part of the substratum, to a depth of about 60 inches, is reddish brown, calcareous loam. In places, the depth to effervescent material is more than 10 inches. In some places, the loam and clay loam glacial till is within a depth of 40 inches.

Permeability of these soils is moderately slow or moderate. The available water capacity is high. Runoff is slow on the Sanilac soil and very slow or ponded on the Bach soil. From November to May, these soils have a high water table. In the Sanilac soil, the water table is at a depth of 1 to 2 feet. In the Bach soil, it is at a depth of 1 foot or less.

In most areas, these soils are used for crops. They have good potential for use as cropland and for pasture and hay crops. The Sanilac soil has good potential for use as woodland, and the Bach soil has fair potential. These soils have poor potential for sanitary facilities and building site development.

If these soils are cultivated, the excess water needs to be removed. Artificial drainage is needed for an optimum yield. Tile lines should be protected with a suitable material so that they do not fill with fine sand and silt. Because the surface layer is calcareous, these soils can be deficient in manganese, boron, and zinc.

If these soils are used for pasture and hay, the excess water needs to be removed. Artificial drainage is needed for optimum plant growth. Water-tolerant pasture plants should be selected for planting.

If these soils are used for trees, management is difficult because the use of equipment is restricted. The loss of seedlings on the Bach soil commonly is high because of wetness, and trees can be blown down during a storm. In wet periods, the use of heavy equipment in planting, tending, and harvesting trees on the Bach soil is restricted.

These soils have severe limitations to building site development and sanitary facilities. If these soils are used for building site development, they need to be artificially drained using surface ditches and tile. Buildings that have a basement should not be constructed because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. If these soils are used for local roads and streets, the upper layer of the soil should be replaced or covered with a suitable base material. If possible, sites on the better drained Sanilac soil should be selected for buildings. Onsite investigation will be needed to evaluate and plan the development of specific sites.

Capability subclass IIw; Michigan soil management groups 2.5b-cs and 2.5c-cs.

63A—Rapson-Bach complex, 0 to 3 percent slopes. This map unit consists of nearly level soils; the Rapson soil is somewhat poorly drained, and the Bach soil is poorly drained. The Rapson soil is on slightly convex uplands and on low knolls and ridges. The Bach soil is in depressions and drainageways and is subject to frequent ponding. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

The areas of this unit are irregular in shape and range from 10 to 120 acres in size. The Rapson soil makes up 35 to 55 percent of the unit, and the Bach soil makes up 20 to 35 percent.

Typically, the surface layer of the Rapson soil is very dark grayish brown loamy fine sand about 9 inches thick. The subsoil is dark brown, loose fine sand about 20 inches thick. The substratum, to a depth of about 60 inches, is multicolored, calcareous, stratified very fine sand, silt loam, and silty clay loam. In places, loam and clay loam glacial till is within a depth of 60 inches. In some places, the sandy surface layer and subsoil are less than 20 inches thick.

Typically, the surface layer of the Bach soil is very dark gray, calcareous very fine sandy loam about 13 inches thick. The subsoil and the upper part of the substratum are grayish brown, mottled, friable, calcareous, stratified very fine sand and silt loam about 37 inches thick. The lower part of the substratum, to a depth of 60 inches, is reddish brown, calcareous loam. In places, the depth to effervescent material is more than 10 inches. In some places, loam and clay loam glacial till is within a depth of 40 inches.

Permeability in the Rapson soil is rapid in the sandy upper part and moderate in the sandy and loamy lower part. It is moderate in the Bach soil. The available water capacity is moderate in the Rapson soil and high in the Bach soil. Runoff is slow or very slow on the Rapson soil and very slow or ponded on the Bach soil. From November to May, these soils have a high water table. In the Rapson soil, the water table is at a depth of 1 to 2 feet. In the Bach soil, it is at a depth of 1 foot or less.

In most areas, these soils are used for crops. They have good potential for use as cropland and for pasture and hay crops. They have fair potential for use as woodland. The Rapson soil has fair potential for building site development, and the Bach soil has poor potential.

If these soils are used for crops, excess water needs to be removed on the Bach soil; on the Rapson soil, excess water needs to be removed during wet periods, soil blowing needs to be controlled and soil moisture conserved during dry periods, and the organic matter content needs to be maintained. These soils generally require artificial drainage to remove excess water. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing. Returning crop residue to the soil helps to conserve soil moisture. Frequently, adding crop residue, barnyard manure, and green manure crops to the soil can maintain the organic matter content. Because the Bach soil has a calcareous surface layer, it may be deficient in manganese, boron, and zinc.

If these soils are used for pasture and hay crops, the major concerns of management are excess water and surface compaction on the Bach soil. Droughtiness in dry periods is the major hazard on the Rapson soil. Artificial drainage is needed to remove excess water. Grazing should be restricted in wet periods. Water-tolerant pasture plants should be selected for planting. The growth of plants on the Rapson soil is reduced in dry periods.

If these soils are used for trees, seedling mortality on the Rapson soil and windthrow and seedling mortality on the Bach soil are moderate hazards. The use of equipment is restricted on the Bach soil; this makes management difficult. The loss of seedlings is common in wet periods in spring and in dry periods in summer. Trees on the Bach soil can be blown down during a storm. The use of heavy equipment in planting, tending, and harvesting trees should be restricted in wet periods.

These soils have severe limitations to building site development and sanitary facilities. If these soils are used for building site development, they need to be artificially drained using surface ditches and tile. Buildings that have a basement should not be constructed because of the high water table. If possible, sanitary facilities should be connected to commercial sewers and treatment facilities. Seepage from sewage lagoons can be prevented by adding a restrictive layer of impervious material. Removal of excess water, retaining walls, and properly maintained slopes can control the caving of cutbanks in shallow excavations. If these soils are used for local roads and streets, the upper layer of the soil should be covered with a suitable base material. If possible, sites on the better drained Rapson soil should be used for buildings. Onsite investigation is needed to evaluate and plan the development of specific sites.

Capability subclass IIIw; Michigan soil management groups 4/2bs and 2.5c-cs.

64B—Londo-Wixom complex, 0 to 4 percent slopes. This map unit consists of nearly level and gently sloping somewhat poorly drained soils on broad, slightly convex uplands and on low knolls and ridges. The areas are irregular in shape and range from 5 to 200 acres in size. The Londo soil makes up 40 to 55 percent of the unit, and the Wixom soil makes up 20 to 40 percent. These soils are so intermingled or the areas of each are so small that is was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Londo soil is very dark grayish brown fine sandy loam about 7 inches thick.

The subsoil is brown, mottled, friable clay loam about 13 inches thick. The substratum, to a depth of about 60 inches, is reddish brown, mottled, calcareous loam.

Typically, the surface layer of the Wixom soil is very dark brown loamy sand about 9 inches thick. The subsurface layer is dark grayish brown sand about 2 inches thick. The upper part of the subsoil, which is about 15 inches thick, is multicolored, loose sand that has chunks of cemented material. The lower part of the subsoil and the substratum, to a depth of 60 inches, are brown, mottled loam. In places, the subsoil is not reddish in color. In some places, the depth to loam or clay loam material is more than 40 inches.

Included with these soils in mapping are small areas of moderately well drained or well drained Guelph soils in slightly higher positions on the landscape and small areas of poorly drained Corunna and Tappan soils in lower positions. Each of these soils makes up 5 to 20 percent of the unit; together, they make up less than 25 percent.

Permeability in the Londo soil is moderate or moderately slow. In the Wixom soil, it is rapid in the sandy upper part and moderately slow in the loamy lower part. The available water capacity is high in the Londo soil and moderate in the Wixom soil. Runoff is slow or medium on the Londo soil and slow on the Wixom soil. From November to May, these soils have a water table at a depth of 1 to 2 feet.

In most areas these soils are used for crops. In some areas, they are used as pasture or woodland. These soils have good potential for pasture and hay crops and for the development of habitat for woodland wildlife. The Londo soil has good potential for use as cropland and woodland and for the development of habitat for openland wildlife; it has fair potential for building site development. The Wixom soil has fair potential for use as cropland and woodland and for building site development.

If these soils are cultivated, excess water in wet periods is the major management concern. Water erosion is a major hazard. Artificial drainage is needed for an optimum yield. Minimum tillage, cover crops, stubble mulching, grassed waterways, diversions, and erosion-control structures help to prevent an excessive loss of soil. Maintaining good soil tilth is a management concern on the Londo soil. Controlling soil blowing, maintaining a high content of organic matter, and conserving moisture in dry periods are management concerns on the Wixom soil. Tilth can be maintained by tilling within the proper range of moisture content, by using minimum tillage, and by incorporating crop residue into the plow layer. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks can help to control soil blowing on the Wixom soil. Returning crop residue to the soil helps to conserve moisture. Frequently, adding crop residue, barnyard manure, and green manure crops to the Wixom soil can maintain the organic matter content.

If these soils are used for pasture and hay crops, excess water in wet periods is the major management concern. Artificial drainage is needed for optimum plant growth. Grazing should be restricted in wet periods. Surface compaction, which is caused by grazing when the soil is wet, is a management concern on the Londo soil. Droughtiness in dry periods is a major hazard on the Wixom soil. The growth of plants on the Wixom soil is reduced during dry periods.

If these soils are used for trees, seedling mortality is a major hazard on the Wixom soil. The loss of seedlings commonly is high in wet periods in spring and in dry periods in summer.

These soils have severe limitations to building site development and sanitary facilities. If these soils are used for building site development, they need to be artificially drained using surface ditches and tile. Buildings that have a basement should not be constructed because of the high water table. If these soils are used for local roads and streets, the upper layer of soil should be replaced or covered with a suitable base material. Because it is better drained, the included Guelph soil is better suited to building site development than the Londo and Wixom soils.

Capability subclass IIw; Michigan soil management groups 2.5b and 4/2b.

65B—Guelph-Menominee complex, 2 to 8 percent slopes. This map unit consists of gently sloping and moderately sloping, well drained or moderately well drained Guelph and Menominee soils. Areas of this unit are irregular in shape and range from 5 to 100 acres in size. Guelph soils make up 30 to 55 percent of the unit, and Menominee soils make up 20 to 40 percent. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used (fig. 9).

Typically, the Guelph soil has a surface layer that is very dark grayish brown sandy loam about 8 inches thick. The subsoil is dark brown clay loam about 14 inches thick. The substratum, to a depth of about 60 inches, is brown mottled calcareous clay loam.

Typically, the Menominee soil has a surface layer that is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer in the upper 2 inches is light brownish gray loamy sand, and in the lower 5 inches it is brown loamy fine sand. The upper part of the subsoil, which is about 17 inches thick, is multicolored sand that has chunks of cemented material. The lower part of the subsoil and the substratum, to a depth of about 60 inches, are brown and dark brown mottled clay loam. In some places, the depth to the clay loam is more than 40 inches.

Included with these soils in mapping are small areas of somewhat poorly drained Londo and Wixom soils and poorly drained Corunna and Tappan soils in slightly lower positions on the landscape. They make up 10 to 25 percent of the map unit.

Figure 9.—Typical area of Guelph-Menominee complex, 2 to 8 percent slopes. The light colored areas are Menominee soils.

Permeability is moderate in the Guelph soil. In the Menominee soil, it is rapid in the sandy upper part and moderately slow in the loamy lower part. The available water capacity is high in the Guelph soil and moderate in the Menominee soil, depending on the slope. From December to April, these soils have a water table at a depth of more than 2 feet.

Most areas of these soils are farmed or are in pasture. A few areas are woodland. These soils have good potential for pasture and hay crops, for woodland use, and for building site development. The Guelph soil has good potential for use as cropland, and the Menominee soil has fair potential. The Guelph soil has good potential for habitat for openland and woodland wildlife.

If these soils are cultivated, water erosion is a major hazard. Minimum tillage, cover crops, mulches, grassed waterways, diversions, and erosion control structures help prevent excessive soil loss.

Maintaining good soil tilth is a major management problem on the Guelph soil. Controlling soil blowing, maintaining a high content of organic matter, and conserving moisture in dry periods are major management problems on the Menominee soil. Good soil tilth can be maintained on the Guelph soil by tilling within the proper range of moisture content, by using minimum tillage, and by incorporating crop residue into the plow layer. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing on the Menominee soil. The content of organic matter in the Menominee soil can be maintained by frequent additions of crop residue, barnyard manure, and green manure. Crop residue helps conserve soil moisture on the Menominee soil.

If these soils are used for pasture and hay, compaction of the surface layer, which is caused by grazing when this soil is wet, is a major management problem on the Guelph soil. Droughtiness on the Menominee soil during dry periods impedes the growth of pasture plants.

If these soils are used for trees, seedling mortality is moderate on the Menominee soil. Some seedling losses can be expected in the dry summer months.

These soils have moderate or severe limitations for building site development and for sanitary facilities. If dwellings with basements are constructed on the Menominee soil, foundations and footings should be designed so that shrinking and swelling of the soils will not damage the structure. Artificial drainage should be provided around foundations, and a suitable base material should be used for backfilling. If they are to function properly, local roads and streets should be graded to shed water, and a suitable base material should be used. Disturbed areas should be covered with a mulch, asphalt spray, or netting, or the areas should be seeded or sodded and fertilized.

Capability subclass IIe; Michigan soil management groups 2.5a and 4/2a.

66A—Pipestone-Tobico fine sands, 0 to 3 percent slopes. This map unit consists of a nearly level, somewhat poorly drained Pipestone soil on low, narrow ridges and a poorly drained Tobico soil in depressions and narrow drainageways. The Tobico soil is subject to frequent ponding. The areas of this map unit are irregular in shape and range from 300 to 2,300 acres in size. The Pipestone soil makes up 50 to 70 percent of the unit, and the Tobico soil makes 30 to 50 percent. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the Pipestone soil has a surface layer that is black fine sand about 4 inches thick. The subsurface layer is light brownish gray fine sand about 4 inches thick. The subsoil and substratum, to a depth of 60 inches, are dominantly brown loose fine sand. In some places, loamy material is within a depth of 60 inches.

Typically, the Tobico soil has a surface layer that is very dark gray fine sand about 8 inches thick. The subsoil is brown, mottled, loose fine sand about 30 inches thick. The substratum, to a depth of about 60 inches, is grayish brown fine sand. In some places, the surface layer is more than 10 inches thick, and, in places, the substratum has strata of gravelly material. Also, in some places, loamy material is within a depth of 60 inches.

Included in mapping are small areas of moderately well drained or well drained Rousseau soils in slightly higher positions on the landscape than the Pipestone soil. In some mapped areas, Rousseau soils make up about 10 percent of the map unit.

Permeability is rapid in the Pipestone soil and very rapid in the Tobico soil. The available water capacity of both soils is low. Runoff is slow or very slow on the Pipestone soil and very slow or ponded on the Tobico soil. From October to June, these soils have a high water table. In the Pipestone soil, the water table is at a depth of 6 inches to 1 1/2 feet, and in the Tobico soil, it is at a depth of 1 foot or less.

Most areas of these soils are woodland or idle farmland. Many areas are used for building site development. A few areas are used for specialty vegetable crops. These soils have good potential for pasture and hay crops and fair potential for cultivated crops. The Pipestone soil has fair potential for building site development. The Pipestone soil has fair potential for use as woodland, and the Tobico soil has poor potential.

If these soils are cultivated, removing excess water in wet periods, controlling soil blowing, and maintaining a high content of organic matter are major management problems. Conserving moisture in dry periods is a problem on the Pipestone soil. Artificial drainage is needed to remove excess water. Because of cutbanks cave-in, open ditches are difficult to maintain, and tile is difficult to install. Tile lines should be protected with a suitable material so that they will not fill with fine sand. Minimum tillage, stubble mulching, cover crops, buffer strips, and windbreaks help control soil blowing, and crop residue helps conserve soil moisture on the Pipestone soil. The content of organic matter can be maintained by frequent additions of crop residue, barnyard manure, and green manure.

If these soils are used for pasture and hay, excess water is the major management problem, and artificial drainage is needed to remove the excess water. Droughtiness in dry periods is a problem on the Pipestone soil. Grazing should be restricted in wet periods. Plants that tolerate wetness should be used. Plant growth is reduced in dry periods on the Pipestone soil.

If these soils are used for trees, the expected seedling loss on the Pipestone soil is high in spring when the soil is wet and in summer when the soil is dry. The loss is high on the Tobico soil because of wetness. The use of heavy equipment for planting, tending, and harvesting trees is restricted in wet periods on the Tobico soil. Windthrow is a hazard on the Tobico soil.

These soils have severe limitations for building site development and for sanitary facilities. If these soils are used for these purposes, they should be artificially drained by surface ditches and tile. Buildings that have basements should not be constructed on these soils because of the high water table. If possible, sanitary facilities should be connected to commercial sewer and treatment facilities. Seepage from sewage lagoons can be prevented by a blanket or layer of impervious material. The caving of cutbanks in shallow excavations can be prevented by removing excess water, constructing retaining walls, and maintaining a proper slope grade. Because it is better drained than these Pipestone and Tobico soils, the included Rousseau soil is better suited to building site development.

Capability subclass IVw; Michigan soil management group 5b and 5c.

67—Belleville loamy sand, ponded. This is a nearly level, poorly drained soil in broad, flat depressions. It is covered with 6 inches to 36 inches or more of water throughout most of the year. Areas of this unit are irregular in shape and range from 5 to 460 acres in size.

Typically, the surface layer is very dark gray loamy sand about 11 inches thick. The subsoil is dominantly grayish brown loose sand about 25 inches thick. The substratum, to a depth of about 60 inches, is multicolored clay loam and loam. In some places, the depth to the loamy substratum is less than 20 inches or more than 40 inches.

Included in mapping and making up about 5 percent of the unit are small areas of the somewhat poorly drained Pipestone soil in slightly higher positions on the landscape.

Permeability is rapid in the sandy upper part of the soil and moderately slow in the loamy lower part.

In most areas, this soil is ponded and is in marsh vegetation. It has fair potential for the development of habitat for wetland wildlife. It has poor potential for other uses unless it is artificially drained and dikes are constructed, but dikes and drainage generally are not economically feasible or practical.

Capability subclass Vw; Michigan soil management group 4/2c.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of the soils for crops and pasture and woodland; as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand, roadfill, and topsoil. Other information indicates the presence of wetness or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are affected by the nature of the soil.

Crops and pasture

Dwight L. Quisenberry, agronomist, Soil Conservation Service, helped write this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; 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 presented for each soil.

This section provides information about the overall agriculture potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

Of Bay County's total land area, 288,640 acres, about 58 percent, or 166,836 acres, is in farms (*8*). In 1974 this farmland consisted of 133,200 acres of harvested cropland, 4,011 acres of cropland used only for pasture, 7,189 acres of other cropland, 10,642 acres of woodland, and 11,794 acres of land in other uses. Abandoned farmland, woodland, wetland, and urban areas make up the rest of county's land area.

Of the total cultivated land in Bay County, about 70 percent was used for row crops, mainly dry beans (41 percent), corn (19 percent), and sugar beets (10 percent). About 14 percent of the cultivated land was in wheat, the main close-grown crop.

Soil drainage is the major management need on about 90 percent of the acreage used for crops and pasture in Bay County. Drainage of cropland improves the air-water relationship in the root zone. Spring planting, weed control, and harvesting operations are hampered if drainage is inadequate. Tile drains and surface drainageways can be used to remove excess water. Some soils, for example, the poorly drained and very poorly drained Belleville soils, Cohoctah loamy fine sand, and Sloan soils, are subject to flooding and are naturally so wet that crop production generally is not possible.

Unless they are artificially drained, the poorly drained and somewhat poorly drained soils, for example, Bach, Belleville, Corunna, Essexville, Londo, Pipestone, Poseyville, Rapson, Sanilac, Tappan, Tobico, and Wixom soils, are so wet that crops are damaged in most years.

Guelph and Menominee soils have good natural drainage most of the year, but small areas of wetter soils along drainageways and in swales are common within areas of these soils. Artificial drainage is needed in those areas. Rousseau soils also have good natural drainage most of the year, but they dry out quickly and do not have sufficient moisture in the dry months of summer. Crops that mature early can be grown if a large amount of organic matter is added to the soil.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of tile drains and ditches is needed in most areas of poorly drained soils that are used intensively for row crops. Drains have to be more closely spaced in soils that are slowly permeable than in the more permeable soils. Drainage is moderately slow or slow in most areas of Londo and Tappan soils where a tile drainage system is used. Adequate outlets for a tile drainage system are difficult to find in many areas of Belleville, Cohoctah, Corunna, Essexville, Sloan, and Tappan soils. Dikes and pumps must be used in some places. Diversions in some areas help to carry runoff away from wet areas. Good soil structure and an ample supply of organic matter help in soil drainage. Information on drainage design for each kind of soil is available in local offices of the Soil Conservation Service.

Soil erosion, including soil blowing, is a major hazard on about one-fourth of the cropland in Bay County. Soil blowing can damage the soils and injure or destroy crops (fig. 10). It is a major hazard on the sandy Belleville, Essexville, Menominee, Pipestone, Pipestone loamy substratum, Poseyville, Rapson, Rousseau, Tobico, and Wixom soils. It can also be a hazard on loamy soils if winds are strong and the soils are dry and bare of vegetation or surface mulch. Vegetative cover, surface mulch, a rough surface through tillage, buffer strips of grain, windbreaks, and irrigation help reduce soil blowing.

Water erosion is a hazard where the slope is more than 2 percent. Guelph and Menominee soils, for exam-

Figure 10.—An area of Wixom loamy sand. Soil blowing is a major hazard in the county.

ple, have slopes of 2 to 8 percent and are subject to erosion. In places, Londo, Poseyville, Rapson, Sanilac, and Wixom soils have slopes of more than 2 percent. They have an additional problem of wetness.

Erosion reduces productivity of the soils because the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a subsoil of clay loam, such as the Guelph soils. Erosion also reduces productivity on soils that tend to be droughty, such as Rapson and Wixom soils. Erosion contributes to the pollution of streams by sediment and thus affects the quality of water for municipal use, recreation, and fish and wildlife.

In some fields where there are spots of clay loam, preparing a good seedbed and tilling are difficult because the original friable soil on the surface has been eroded away. Such spots are common in areas of Londo, Menominee, and Guelph soils.

Erosion control practices help protect the surface, reduce runoff, and increase infiltration. A cropping system that keeps a vegetative cover on the soil can hold the loss of soil through erosion to an amount that will not reduce the production capacity of the soils. On livestock farms, the legume and grass forage crops in the cropping system reduce erosion on sloping land. Also they improve soil structure and tilth and provide nitrogen for the crop that follows.

Water erosion is a major hazard along streams and open ditches in Bay County. Runoff from fields, roadways, and construction sites carries sediment into streams and ditches and forms gullies. The sediment clogs the streams and ditches and reduces the quality of the water. The sediment is expensive to remove. The banks of the streams and ditches cave in and erode during periods of peak flow. Measures that can help reduce erosion include vegetative cover, mulching, grassed waterways, diversions, grade stabilization structures, channel linings, and sediment basins (fig. 11).

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

In Bay County, tilth is a problem on some soils. The dark colored loamy Tappan soils often stay wet until late in spring. If these soils are wet when plowed or when tillage or harvesting equipment is used, they tend to be very cloddy when dry and their subsoil becomes compacted. Good seedbeds are difficult to prepare.

Some of the soils in Bay County that are used for crops have a surface layer of loam that is light in color and low in content of organic matter. Generally, the structure of such a soil is weak. Intense rainfall can result in the formation of a crust on the surface. The crust reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material help improve soil structure and reduce crust formation. Limiting the use of heavy equipment when the soil is wet helps reduce soil compaction.

Field crops commonly grown in Bay County include row crops—dry beans, corn, sugar beets, and soybeans—and close-grown crops—wheat is the most common crop, but rye and oats can be grown as well. If artificially drained, loamy soils that are poorly drained and somewhat poorly drained are especially well suited to these crops.

Specialty crops grown commercially in Bay County are small fruits, tree fruits, and nursery stock. Vegetables are grown on about 11,500 acres in the county. Potatoes, grown in many places under irrigation, and cucumbers are the main vegetables. These crops are well adapted to the sandy soils throughout the county. A small acreage scattered throughout the county is used for pumpkins, peppers, sweet corn, cabbage, cantaloupes, tomatoes, onions, peas, and cauliflower (fig. 12).

Sandy soils that are moderately well drained and somewhat poorly drained and that warm up early in spring, for example, Menominee, Pipestone, Rousseau, and Wixom soils, are especially well suited to vegetables and small fruits. Irrigation and artificial drainage can be used to obtain optimum yeilds. Crops can generally be planted and harvested earlier on these soils than on the other soils in Bay County.

The latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

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 5. 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. Absence of an estimated yield indicates that the soil is not suited to the crop or the crop is not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil

Figure 11.—An erosion control structure in an area of the Guelph-Menominee complex, 2 to 8 percent slopes. The structure safely carries surface water from the area into an open ditch.

moisture is favorable; 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 residues, barnyard manure, and green manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils 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 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops (*6*). The soils are classed according to their limitations

Figure 12.—Pumpkins, in a field of Tappan loam, and similar crops are important to the agricultural industry in Bay County.

when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. The capability classes and subclasses are defined in the following paragraphs. A survey area may not have soils of all classes.

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 landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too 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, though 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 indicated in table 6. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

The capability subclass to which a soil has been assigned is given at the end of the description of each soil in the section "Soil maps for detailed planning."

Also given at the end of each description is a Michigan soil management group. The soils are assigned to a group according to needs for lime and fertilizer, artificial drainage, and other practices. For soils making up a soil complex, the soil management groups are listed in the same order as the series named in the complex.

The Michigan soil management groups combine soils of similar profiles, texture, and natural drainage conditions. The groups are designated by numbers and letters that identify significant soil properities affecting various uses.

In mineral soils a number identifies the dominant texture: *0* indicates more than 60 percent clay; *1* indicates 40 to 60 percent clay; *1.5* indicates clay loam and silty clay loam; *2.5* indicates loam and silt loam; *3* indicates sandy loam; *4* indicates loamy sand; and *5* indicates sand. Soils that developed in uniform parent material are identified by a single number. Soils that developed from two different parent materials or that have contrasting textures in the profile are identified by fractions. The numerator indicates the texture in the upper part of the profile, and the denominator indicates the texture in the lower part of the profile, or the parent material. For example, *3/2* indicates that soils are sandy loam, 20 to 40 inches thick over loam to silty clay loam.

For alluvial soils, the numbers are preceded by *L*. For soils that are 20 to 40 inches deep to bedrock, the texture of the overlying material is the numerator of the fraction: for example, *3/R* means sandy loam over bedrock.

Organic soils, muck or peat, are identified by *M*. The 16- to 51-inch organic soils are identified according to the texture of the underlying mineral material: *M/3*, for example, means muck over sandy loam to clay loam; *M/4*, muck over loamy sand or sand; *M/m*, muck over marl. Organic soils that are more than 51 inches thick are identified only by the letter *M*.

Lower case letters after the capital letter or the numbers indicate natural drainage conditions: *a* indicates well drained and moderately well drained; *b* indicates somewhat poorly drained; and *c* indicates poorly drained and very poorly drained.

Other soil characteristics important to land use planning are indicated by adding a dash and a second lower case letter to the symbol. For example, *a* after a dash identifies soils that have a very strongly acid (ph less than 4.5) subsoil. An *s* indicates stratification with fine sand and silt.

For a detailed explanation of the Michigan soil management groups, refer to the Michigan State University Research Report 254, *Soil Management Units and Land Use Planning* (*4*).

Woodland management and productivity

Table 7 contains information useful to woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland 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 important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 7 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This 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. Important 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.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species 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 depending on erodibility of the soil. They protect cropland and crops from wind, hold 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. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 8 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 8, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were 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 or aggregation, in-place soil density, and geologic origin of the soil material. If pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the large scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil are included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 9 shows, for each kind of soil, the degree and kind of limitations for building site development; table 10, for sanitary facilities; and table 12, for water management. Table 11 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without a basement, small commercial buildings, local roads and streets, and lawns and landscaping are indicated in table 9. A *slight* limitation indicates that soil properties generally are favorable for the specified use and that limitations are minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils that are rated severe, costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 9 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Slope is also an important consideration in the choice of sites for these structures and was considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 9 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, and depth to rock or to very compact layers affect stability and ease of excavation.

Lawns and landscaping require soils that are suitable for the establishment and maintenance of turf for lawns and ornamental trees and shrubs for landscaping. The best soils are firm after rains, are not dusty when dry, and absorb water readily and hold sufficient moisture for plant growth. The surface layer should be free of stones. If shaping is required, the soils should be thick enough over hardpan to allow for necessary grading. In rating the soils, the availability of water for sprinkling is assumed.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 10 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which mean about the same as *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 60 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, and susceptibility to flooding. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed, or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 10 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 11 by ratings of good, fair, or poor. The texture, thickness, and organic matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 5 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 15 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, or wetness. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor.*

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel. Nowhere in Bay County is the upper 6 feet of soil material a suitable source of commercial gravel for construction.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 15.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick.

Soils rated *poor* are very sandy soils and very firm clayey soils, soils with suitable layers less than 8 inches thick, and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 12, soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Organic matter in a soil downgrades the suitability of the soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 12 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability, texture, hardpan or other layers that affect the rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, alkalinity, and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; hardpan or other unfavorable material; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 13 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 13 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 10, and interpretations for dwellings without basements and for local roads and streets, given in table 9.

Camp areas require such site preparation as shaping and leveling for 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 for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones, absorbs rainfall readily but remains firm, and is not dusty when dry.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 that will 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, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They should have a surface that is free of stones and have moderate slopes. Suitability of the soil for traps, tees, or greens was not considered in rating the soils. Irrigation is an assumed management practice.

Wildlife habitat

James Hammill, wildlife habitat biologist, Michigan Department of Natural Resources, helped write this section.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 14 the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and 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* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties 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, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley, rye, buckwheat, sorghum, soybeans and other dry beans, and browntop millet.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bromegrass, clover, alfalfa, sudangrass, orchardgrass, switchgrass, creeping bentgrass, redtop, timothy, Japanese millet, crownvetch, and birdsfoot trefoil.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are goldenrod, strawberry, dandelion, lambsquarter, milkweed, ragweed, nightshade, burdock, mullein, and native grasses.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, maple, poplar, birch, cherry, apple, hawthorn, dogwood, hickory, blackberry, nannyberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, and slope. Examples of wetland plants are smartweed, wild millet, rushes, sedges, reeds, pondwood, arrowhead, pickerelweed, and duckweed.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are wetness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, red-winged blackbird, hawks, cottontail rabbit, red fox, deer, woodchuck, and opossum.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, woodcock, thrushes, woodpeckers, warblers, nuthatches, squirrels, raccoon, deer, and porcupine.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, kingfisher, bittern, cranes, snipe, marsh hawks, shore birds, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, or coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

Engineering properties

Table 15 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 15 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 15 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 15. Also in table 15 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 16 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 17 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils 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.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*7*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 18, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquolls (*Hapl*, meaning minimum horizons, plus *aquoll*, the suborder of Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups 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 is thought to typify the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed (calcareous), mesic, Typic Haplaquolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*5*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Bach series

The Bach series consists of poorly drained, moderately permeable soils in depressions and in drainageways on till plains that have been modified by lake water. These soils formed in calcareous lacustrine sediment. The slope is 0 to 1 percent. In this county, Bach soils have a thicker surface layer than that defined in the range for the Bach series. This difference does not affect their use or behavior.

Bach soils are similar to Corunna soils and are adjacent to Rapson, Sanilac, and Tappan soils. Corunna soils are noncalcareous and coarse-loamy and are on similar positions on the landscape. Rapson soils are better drained than Bach soils, sandy in the upper part of the profile, noncalcareous, and on low knolls and ridges. Sanilac soils are better drained than Bach soils and are on low knolls and ridges. Tappan soils are fine-loamy and are on similar positions on the landscape.

Typical pedon of Bach very fine sandy loam, in an area of Rapson-Bach complex, 0 to 3 percent slopes, 310 feet east and 310 feet north of SW corner of sec. 14, T. 15 N., R. 3 E.

Ap—0 to 13 inches; very dark gray (10YR 3/1) very fine sandy loam; dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable; very slight effervescence; mildly alkaline; clear wavy boundary.

B2g—13 to 29 inches; grayish brown (2.5Y 5/2) stratified very fine sand and silt loam; few fine prominent yellowish brown (10YR 5/4) and light olive brown (2.5Y 5/6) mottles; weak fine subangular blocky structure; very friable; common very dark grayish brown (10YR 3/2) organic stains; slight effervescence; mildly alkaline; abrupt wavy boundary.

C1g—29 to 50 inches; grayish brown (10YR 5/2) stratified very fine sand and silt loam; few fine prominent yellowish brown (10YR 5/4) and light olive brown (2.5Y 5/6) mottles; massive; friable; slight effervescence; moderately alkaline; abrupt wavy boundary.

IIC2—50 to 60 inches; reddish brown (5YR 5/3) loam; common fine prominent yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) and few fine prominent grayish brown (10YR 5/2) mottles; massive; firm; violent effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. Effervescent material is at a depth of 0 to 10 inches. The mollic epipedon is 10 to 15 inches thick.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly very fine sandy loam but ranges from fine sandy loam to silt loam.

The B2g horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 or 2. It is stratified. The texture ranges from very fine sand to silty clay loam.

The C1g horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is stratified. The texture is similar to that in the B2g horizon.

There is no IIC2g horizon in some pedons. If present, it is loam or clay loam.

Belleville series

The Belleville series consists of poorly drained soils in depressions and in drainageways on till plains modified by lake water. These soils formed in sandy glaciofluvial deposits over loamy lacustrine or till material. The slope is 0 to 1 percent. Permeability is rapid in the sandy upper part of the profile and moderately slow in the loamy lower part. In this county, Belleville soils have brighter colors in the subsoil and carbonates are at a greater depth than defined in the range for the Belleville series. These differences do not affect their use or behavior.

Belleville soils are similar to Essexville and Tobico soils and are adjacent to Cohoctah, Tobico, Tappan, and Wixom soils on the landscape. Essexville soils are calcareous and are on similar positions on the landscape. Cohoctah soils are alluvial and are in abandoned drainageways and on first bottom lands. Tobico soils do not have a loamy substratum and are on similar positions on the landscape. Wixom soils are better drained than Belleville soils, have spodic and argillic horizons, and are on slightly higher positions on the landscape. Tappan soils are fine-loamy and are on similar positions on the landscape.

Typical pedon of Belleville loamy sand, 950 feet east and 120 feet north of the SW corner of sec. 13, T. 13 N., R. 4 E.

Ap—0 to 11 inches; very dark gray (10YR 3/1) loamy sand; dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

B21g—11 to 22 inches; grayish brown (10YR 5/2) sand with dark brown (10YR 3/3) streaks; single grained; loose; slightly acid; abrupt smooth boundary.

B22g—22 to 36 inches; grayish brown (10YR 5/2) sand; single grained; loose; few lenses of loamy sand; slightly acid; abrupt wavy boundary.

IIC1g—36 to 40 inches; dark gray (N 4/0) clay loam; many coarse prominent reddish brown (5YR 4/4) mottles; massive; firm; neutral; abrupt wavy boundary.

IIC2g—40 to 50 inches; grayish brown (10YR 5/2) loam; many medium to coarse prominent dark yellowish brown (10YR 4/6) mottles; massive; firm; neutral; gradual wavy boundary.

IIC3g—50 to 60 inches; gray (5Y 5/1) loam; few fine faint greenish gray (5G 6/1) mottles; massive; firm; slight effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. It is slightly acid to mildly alkaline. Effervescent material is at a depth of 20 to 50 inches. The mollic epipedon is 10 to 16 inches thick.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy sand, but the range includes loamy fine sand.

The B2g horizon is loamy fine sand, fine sand, or sand. It has value of 4 or 5 and chroma of 1 or 2. There is a Cg horizon in some pedons.

Cohoctah series

The Cohoctah series consists of poorly drained and very poorly drained, moderately rapidly permeable soils on flood plains and in abandoned streambeds. These soils formed in sandy and loamy alluvium. The slope is 0 to 1 percent. These soils have brighter colors below the surface layer and have less stratification in organic matter than defined in the range for the Cohoctah series. These differences do not affect their use or behavior.

Cohoctah soils are similar to Sloan soils and are adjacent to Corunna, Sloan, and Tappan soils on the landscape. Sloan soils are fine-loamy and are calcareous. They are in similar positions on the landscape. Corunna and Tappan soils did not form in alluvium, and they are on slightly higher positions on the landscape. Tappan soils are fine-loamy and are calcareous. Typical pedon of Cohoctah loamy fine sand, 1,350 feet north and 227 feet west of the SE corner of sec. 6, T. 13 N., R. 5 E.

Ap—0 to 11 inches; black (10YR 2/1) loamy fine sand, dark brown (10YR 4/1) dry; weak fine granular structure; very friable; mildly alkaline; abrupt wavy boundary.

A12—11 to 18 inches; very dark grayish brown (10YR 3/2) fine sandy loam; gray (10YR 5/1) dry; weak medium platy structure; very friable; neutral; abrupt wavy boundary.

C1g—18 to 25 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak medium subangular blocky structure; very friable; neutral; abrupt wavy boundary.

C2g—25 to 40 inches; dark grayish brown (10YR 4/2) fine sandy loam; common fine prominent yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure grading to massive; very friable; mildly alkaline; abrupt wavy boundary.

C3—40 to 60 inches; brown (10YR 5/3) loamy fine sand; few medium prominent olive yellow (2.5Y 6/6) and gray (10YR 6/1) mottles; massive; very friable; violent effervescence; moderately alkaline.

In the upper part of the pedon, the soil ranges from slightly acid to mildly alkaline, and in the lower part it is mildly alkaline or moderately alkaline.

The A horizon is dominantly fine sandy loam or loamy fine sand, but the range includes loam, sandy loam, or loamy sand.

The C horizon has hue of 10YR, 7.5YR, 5YR, and 2.5YR; value of 3 to 6; and chroma of 1 to 3. Layers having larger amounts of organic matter or a buried A horizon have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The C horizon is loam, sandy loam, fine sandy loam, or loamy fine sand. It has thin layers and lenses of sand, loamy sand, loamy very fine sand, silt loam, mucky silt loam, mucky loam, and muck.

Corunna series

The Corunna series consists of poorly drained soils in depressions and in drainageways on till plains modified by lake water. The soils formed in sandy loam glaciofluvial deposits over loamy lacustrine or till material. The slope is 0 to 1 percent. Permeability is moderate in the subsoil and moderately slow in the substratum. These soils have brighter colors in the subsoil than those defined in the range for the Corunna series. This difference does not affect their use or behavior.

Corunna soils are similar to Bach and Tappan soils and are adjacent to Cohoctah and Tappan soils on the landscape. Bach soils are coarse-silty and calcareous and are on similar positions on the landscape. Cohoctah soils formed in alluvium and are in slightly lower positions on the landscape. Tappan soils are fine-loamy and calcareous and are on similar positions on the landscape.

Typical pedon of Corunna sandy loam, in an area of Corunna-Tappan sandy loams, 580 feet east and 160 feet north of the SW corner of sec. 5, T. 13 N., R. 4 E.

Ap—0 to 10 inches; very dark gray (10YR 3/1) sandy loam; weak fine granular structure; friable; many roots; neutral; abrupt wavy boundary.

Bg—10 to 29 inches; dark grayish brown (10YR 4/2) sandy loam; weak medium and coarse subangular blocky structure; friable; common roots; black (10YR 2/1) streaks; gravelly layer at bottom; mildly alkaline; abrupt irregular boundary.

IIC1g—29 to 31 inches; dark grayish brown (10YR 4/2) clay loam; common medium prominent dark yellowish brown (10YR 4/6) mottles; moderate fine and medium angular blocky structure; firm; violent effervescence; moderately alkaline; clear wavy boundary.

IIC2g—31 to 41 inches; grayish brown (10YR 5/2) loam; common medium prominent dark yellowish brown (10YR 4/6) mottles; moderate coarse subangular blocky structure; firm; violent effervescence; moderately alkaline; clear wavy boundary.

IIC3—41 to 60 inches; brown (10YR 4/3) and grayish brown (10YR 5/2) loam; common fine distinct dark yellowish brown (10YR 4/6) mottles; massive; firm; violent effervescence; moderately alkaline.

The thickness of the solum, the depth to effervescent material, and the depth to the IIC horizon range from 20 to 40 inches. The solum is slightly acid to mildly alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly sandy loam, but the range includes loam or fine sandy loam.

The Bg horizon has value of 4 to 6 and chroma of 1 or 2. It is loamy fine sand, sandy loam, or fine sandy loam.

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

Essexville series

The Essexville series consists of poorly drained soils in depressions and in drainageways on till plains modified by lake water. These soils formed in sandy glaciolacustrine deposits over loamy till material. The slope is 0 to 1 percent. Permeability is rapid in the sandy upper part of the profile and moderately slow in the loamy lower part.

Essexville soils are similar to Belleville and Tobico soils and are adjacent to Tappan and Wixom soils on the landscape. Belleville soils are noncalcareous and are on similar positions on the landscape. Tobico soils are sandy throughout the profile. Tappan soils are fine-loamy and are on similar positions on the landscape. Wixom soils are better drained than Essexville soils, are noncalcareous, have a thinner surface layer, have spodic and argillic horizons, and are on higher positions on the landscape.

Typical pedon of Essexville loamy sand, 300 feet north and 1,215 feet west of the center of sec. 25, T. 14 N., R. 6 E.

Ap—0 to 11 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; few fine prominent dark brown (7.5YR 4/4) mottles; weak fine granular structure; very friable; common fine roots; very slight effervescence; mildly alkaline; clear wavy boundary.

B2g—11 to 16 inches; dark grayish brown (10YR 4/2) sand; few fine distinct dark brown (7.5YR 4/4) mottles; single grained; loose; few fine roots; very slight effervescence; mildly alkaline; gradual irregular boundary.

C1—16 to 26 inches; pale brown (10YR 6/3) sand; few fine prominent strong brown (7.5YR 5/6) and few fine distinct brownish yellow (10YR 6/6) mottles; single grained; loose; few fine roots; very slight effervescence; mildly alkaline; abrupt smooth boundary.

IIC2g—26 to 46 inches; grayish brown (10YR 5/2) loam, few fine distinct yellowish brown (10YR 5/4) and few fine faint gray (10YR 6/1) mottles; massive; friable; slight effervescence; mildly alkaline; clear wavy boundary.

IIC3g—46 to 60 inches; gray (10YR 6/1) loam; common medium prominent yellowish brown (10YR 5/6) and few medium faint grayish brown (10YR 5/2) mottles; massive; friable; strong effervescence; moderately alkaline.

The IICg horizon is typically at a depth of 18 to 30 inches and ranges to 40 inches. Effervescent material is at a depth of 0 to 10 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy sand, but the range includes sand, fine sand, and loamy fine sand. The A horizon ranges from 10 to 14 inches in thickness.

The B2g horizon has value of 4 to 6 and chroma of 1 or 2. In many pedons, this horizon is mottled. It is sand, fine sand, loamy sand, or loamy fine sand.

There is no C1 horizon in some pedons. The IICg horizon has hue of 2.5Y, 10YR, 7.5YR, or 5YR; value of 4 to 6; and chroma of 1 to 8. It is loam, clay loam, or silty clay loam.

Guelph series

The Guelph series consists of well drained and moderately well drained, moderately permeable soils in upland areas on moraines and knolls. These soils formed in calcareous loamy glacial till. The slope ranges from 2 to 8 percent.

Guelph soils are similar to Londo soils and are commonly adjacent to Londo, Menominee, and Wixom soils on the landscape. Londo soils are wetter than Guelph soils, have low chroma mottles in the upper 10 inches of the argillic horizon, and are on slightly lower positions on the landscape. Menominee soils are sandy over loamy and are on similar positions on the landscape. Wixom soils are wetter than Guelph soils, have sandy material over loamy material, and are on slightly lower positions on the landscape.

Typical pedon of Guelph sandy loam, in an area of Guelph-Menominee complex, 2 to 8 percent slopes, 1,435 feet west and 1,150 feet south of the NE corner of sec. 4, T. 18 N., R. 3 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam; light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

B&A—8 to 15 inches; dark brown (7.5YR 4/4) clay loam (B2t); weak medium subangular blocky structure; friable with interfingers of brown (10YR 5/3) sandy loam and loamy sand (A2); friable; common roots; common thin black (10YR 2/1) organic stains in pores; neutral; clear irregular boundary.

B2t—15 to 22 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; many thin clay films on faces of peds and in pores;

few thin black (10YR 2/1) organic stains in pores; neutral; abrupt irregular boundary.

C1—22 to 32 inches; brown (7.5YR 5/4) clay loam; massive; firm; few light gray (10YR 7/1) lime coatings; slight effervescence; mildly alkaline; abrupt irregular boundary.

C2—32 to 60 inches; brown (7.5YR 5/4) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; massive; firm; few light gray (10YR 7/1) lime coatings on faces of peds; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to effervescent material range from 12 to 25 inches. The solum is slightly acid to mildly alkaline.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Value for dry soil is 6 or more. This horizon is dominantly sandy loam, but the range includes loam and fine sandy loam. In some pedons there is an A2 horizon. In the B&A horizon, fingers of A2 material between 2 and 10 millimeters wide penetrate the B2t horizon. In some pedons these horizons are incorporated into the Ap horizon.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or silty clay loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. In most pedons, it is loam or clay loam and is mottled below a depth of 30 inches.

Londo series

The Londo series consists of somewhat poorly drained, moderately permeable or moderately slowly permeable soils on uplands and on low knolls and ridges on moraines and till plains. These soils formed in calcareous, loamy glacial till. The slope ranges from 0 to 4 percent. In this county, Londo soils have brighter colors in the subsoil than those defined for the Londo series. This difference does not affect their use or behavior.

Londo soils are similar to Guelph soils and are commonly adjacent to Guelph, Menominee, Tappan, and Wixom soils. Guelph soils are better drained than Londo soils and are in slightly higher positions on the landscape. Menominee soils are better drained than Londo soils, have sandy material over loamy material, and are in slightly higher positions on the landscape. Tappan soils are wetter than Londo soils, are fine-loamy, have a thicker surface layer, and are on slightly lower positions on the landscape. Wixom soils have sandy material over loamy material and are on similar positions on the landscape.

Typical pedon of Londo fine sandy loam, in an area of Londo-Wixom complex, 0 to 4 percent slopes, 2,304 feet north and 350 feet west of the SE corner of sec. 4, T. 18 N., R. 3 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) fine sandy loam; light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many roots; slightly acid; abrupt smooth boundary.

B&A—7 to 10 inches; brown (7.5YR 4/4) clay loam (B2t); moderate fine subangular blocky structure; friable; interfingers of pale brown (10YR 6/3) fine sandy loam (A2); common roots; slightly acid; clear broken boundary.

B2t—10 to 20 inches; brown (7.5YR 4/4) clay loam; common fine prominent dark grayish brown (10YR 4/2) mottles; moderate fine subangular blocky structure; friable; brown (10YR 5/3) clay films on faces of peds and in pores; few lenses of sandy loam; few roots; neutral; abrupt wavy boundary.

C1—20 to 42 inches; reddish brown (5YR 5/3) loam; common fine prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; many light gray (10YR 7/1) lime coatings on faces of peds and in pores; violent effervescence; moderately alkaline; abrupt wavy boundary.

C2—42 to 60 inches; mixed, reddish brown (5YR 5/3) and yellowish brown (10YR 5/6) loam; few fine prominent gray (10YR 6/1) mottles; massive; friable; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to effervescent material range from 12 to 25 inches. The solum is slightly acid to mildly alkaline.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. Value for dry soil is 6. This horizon is loam or fine sandy loam. There is an A2 horizon in some pedons. The B&A horizon has the color and texture of the A2 horizon and the underlying B horizon. In the B&A horizon, fingers of material between 2 and 10 millimeters wide penetrate the B2t horizon. In some pedons, these horizons have been incorporated into the Ap horizon.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. Mottles of low chroma are within the upper 10 inches of the B2t horizon.

The C horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 to 6; and chroma of 2 to 6. It is loam or clay loam.

Menominee series

The Menominee series consists of well drained and moderately well drained soils on upland areas of moraines and on knolls and ridges on till plains. These soils formed in 20 to 40 inches of sandy glacial drift over loamy glacial till. The slope ranges from 2 to 8 percent. Permeability is rapid in the sandy upper part of the profile and moderately slow in the loamy lower part. These soils have a slightly higher soil temperature than that defined in the range for the Menominee series. This difference does not affect their use or behavior.

Menominee soils are similar to Wixom soils and are commonly adjacent to Guelph, Londo, and Wixom soils on the landscape. Guelph soils are fine-loamy and are in similar positions on the landscape. Londo soils are wetter than Menominee soils, are fine-loamy, and are in slightly lower positions on the landscape. Wixom soils are wetter than Menominee soils and are in slightly lower positions on the landscape.

Typical pedon of Menominee loamy sand, in an area of Guelph-Menominee complex, 2 to 8 percent slopes, 1,435 feet west and 1,111 feet south of the NE corner of sec. 4, T. 18N., R. 3 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand; light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many roots; medium acid; abrupt smooth boundary.

A2—9 to 11 inches; light brownish gray (10YR 6/2) loamy sand; weak fine structure; very friable; many roots; slightly acid; abrupt broken boundary.

B21hir—11 to 22 inches; dark reddish brown (5YR 3/4) sand; massive; weakly cemented; few roots; slightly acid; abrupt broken boundary.

B22ir—22 to 28 inches; dark brown (7.5YR 4/4) sand; single grained; loose; few dark reddish brown (5YR 3/4) weakly cemented chunks of ortstein; few roots; slightly acid; clear wavy boundary.

A'2—28 to 33 inches; brown (10YR 5/3) loamy fine sand; weak fine granular structure; very friable; few roots; slightly acid; abrupt wavy boundary.

IIB'2t—33 to 38 inches; mixed brown (7.5YR 5/4) and dark brown (7.5YR 4/4) clay loam; common fine prominent light brownish gray (10YR 6/2) mottles; massive; firm; few roots; neutral; abrupt wavy boundary.

IIC—38 to 60 inches; mixed brown (7.5YR 5/4) and dark brown (7.5YR 4/4) clay loam; few fine prominent gray (10YR 6/1) mottles; massive; firm; slight effervescence; mildly alkaline.

The IIB'2t horizon is at a depth of 20 to 40 inches. The sandy part of the solum ranges from medium acid to neutral.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. It is dominantly loamy sand, but the range includes loamy fine sand. In some pedons, there are no A2 and A'2 horizons.

The B2 horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 or 4, and chroma of 3 to 6. It is sand or fine sand. In some pedons, there are no chunks of ortstein.

The IIB'2t and IIC horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 4. The texture is loam, clay loam, or silty clay loam.

Pipestone series

The Pipestone series consists of somewhat poorly drained, rapidly permeable soils on uplands and on low knolls and ridges on lake plains, outwash plains, and till plains modified by lake water. These soils formed in sandy glacial drift. The slope ranges from 0 to 3 percent.

Pipestone soils are similar to Rousseau soils and are adjacent to Rousseau and Tobico soils. Rousseau soils are better drained than Pipestone soils; they do not have mottling in the spodic horizon and are on slightly higher positions on the landscape. Tobico soils are wetter than Pipestone soils, do not have spodic development in the subsoil, and are on slightly lower positions on the landscape.

Typical pedon of Pipestone fine sand, 0 to 3 percent slopes, 1,848 feet south and 545 feet east of the NW corner of sec. 35, T. 14 N., R. 4 E.

A1—0 to 4 inches; black (10YR 2/1) fine sand; weak fine granular structure; very friable; many roots; very strongly acid; abrupt wavy boundary.

A2—4 to 8 inches; light brownish gray (10YR 6/2) fine sand; few fine faint dark grayish brown (10YR 4/2) organic stains; single grained; loose; common roots; strongly acid; abrupt wavy boundary.

B21ir—8 to 12 inches; reddish brown (5YR 4/4) fine sand; few fine and medium distinct dark reddish brown (5YR 3/2) mottles; single grained; loose; few roots; strongly acid; clear wavy boundary.

B22ir—12 to 19 inches; brown (7.5YR 5/4) fine sand; few fine distinct dark grayish brown (10YR 4/2) mottles; single grained; loose; slightly acid; clear wavy boundary.

B3—19 to 30 inches; brown (10YR 4/3) fine sand; few fine faint dark grayish brown (10YR 4/2) mottles; single grained; loose; slightly acid; gradual wavy boundary.

C1—30 to 60 inches; brown (10YR 5/3) fine sand; common fine faint very dark grayish brown (10YR 3/2) mottles; single grained; loose; neutral.

The solum is 20 to 46 inches thick. It ranges from very strongly acid to slightly acid. The texture throughout the 10- to 40-inch control section is dominantly fine sand.

The A1 horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is 1 to 5 inches thick. In cultivated areas, there is an Ap horizon that is 6 to 10 inches thick. In some pedons, there is no A2 horizon.

The B2ir horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 to 5; and chroma of 2 to 6. In some pedons, there are weakly to strongly cemented chunks of ortstein. In some pedons, there is no B3 horizon.

The C horizon has hue of 10YR, 7.5YR, or 5YR; value of 5 to 7; and chroma of 2 to 6. It ranges from strongly acid to mildly alkaline. In some pedons, there is a IIC2 horizon that is loam or clay loam below a depth of 40 inches.

Poseyville series

The Poseyville series consists of somewhat poorly drained soils on uplands and on low knolls and ridges on till plains modified by lake water. The soils formed in glacial drift that is sandy in the upper part and loamy in the lower part. The slope ranges from 0 to 3 percent. Permeability is rapid in the sandy upper part of the profile and moderate to moderately slow in the loamy lower part.

Poseyville soils are similar to Londo and Wixom soils and are adjacent to Londo, Tappan, and Wixom soils. Londo soils are fine-loamy, do not have sandy upper horizons, and are on similar positions on the landscape. Tappan soils are wetter than Poseyville soils, are fine-loamy, do not have sandy upper horizons, and are on slightly lower positions on the landscape. Wixom soils have a sandy upper part, 20 to 40 inches thick, and a spodic horizon, and they are on similar positions on the landscape.

Typical pedon of Poseyville loamy sand, in an area of Tappan-Poseyville complex, 0 to 3 percent slopes, 2,000 feet south and 300 feet west of the NE corner of sec. 2, T. 16 N., R. 3 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loamy sand; grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; common roots; mildly alkaline; abrupt smooth boundary.

B1—7 to 13 inches; yellowish brown (10YR 5/4) sandy loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; single grained; loose; common roots; mildly alkaline; abrupt wavy boundary.

B2t—13 to 16 inches; dark yellowish brown (10YR 4/4) sandy loam; few fine distinct grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; very friable; clay bridging between sand grains; common roots; mildly alkaline; abrupt wavy boundary.

IIC1—16 to 22 inches; grayish brown (10YR 5/2) very fine sand and silt loam; many coarse prominent yellowish brown (10YR 5/6) mottles; massive; very friable; few roots; violent effervescence; moderately alkaline; abrupt wavy boundary.

IIIC2—22 to 48 inches; reddish brown (5YR 5/3) loam; common medium prominent yellowish brown (10YR 5/8) and few fine faint grayish brown (10YR 5/2) mottles; massive; friable; violent effervescence; moderately alkaline; abrupt wavy boundary.

IIIC3—48 to 60 inches; dark brown (10YR 4/3) loam; few fine faint yellowish brown (10YR 5/4) mottles; weak fine angular blocky structure; firm; violent effervescence; moderately alkaline.

The thickness of the solum and the depth to effervescent material range from 13 to 24 inches. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly loamy sand, but the range includes loamy fine sand.

The B1 horizon is sand or fine sand. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 6. It is fine sandy loam or sandy loam.

The IIC1 horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is a stratified layer of very fine sand and silt. In some pedons, there is no IIC1 horizon.

The IIIC horizon has hue of 10YR to 5YR, value of 4 to 6, and chroma of 1 to 6. It is loam or clay loam.

Rapson series

The Rapson series consists of somewhat poorly drained soils in uplands and on low knolls and ridges on lake plains. These soils formed in lacustrine sediment, 20 to 40 inches thick, that is sandy in the upper part and sandy and loamy in the lower part. The slope ranges from 0 to 3 percent. Permeability is rapid in the upper part of the profile and moderate in the lower part.

Rapson soils are similar to Wixom soils and are commonly adjacent to Bach, Sanilac, and Tappan soils on the landscape. Wixom soils have an argillic horizon and have less very fine sand and silt in the substratum than Rapson soils. Bach soils are wetter than Rapson soils, do not have a sandy solum, and are on slightly lower positions on the landscape. Sanilac soils do not have a sandy solum and are on similar positions on the landscape. Tappan soils are wetter than Rapson soils, are fine-loamy, and are on slightly lower positions on the landscape.

Typical pedon of Rapson loamy fine sand, in an area of Rapson-Bach complex, 0 to 3 percent slopes, 35 feet west and 880 feet south of the center of sec. 15, T. 15 N., R. 3 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3.2) loamy fine sand; weak fine granular structure; very friable; common roots; slightly acid; abrupt wavy boundary.

B21hir—9 to 16 inches; dark brown (7.5YR 3/4) and yellowish brown (10YR 5/6) fine sand; single grained; loose; few dusky red (2.5YR 3/2) strongly cemented chunks of orstein; medium acid; clear wavy boundary.

B3—16 to 29 inches; dark brown (7.5YR 4/4) fine sand; many medium faint dark yellowish brown (10YR 4/4) and few fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very friable; mildly alkaline; abrupt boundary.

IIC1—29 to 50 inches; yellowish brown (10YR 5/4) stratified very fine sand and silt loam; few medium distinct grayish brown (10YR 5/2) mottles; massive; very friable; slight effervescence; moderately alkaline; clear wavy boundary.

IIC2g—50 to 60 inches; pinkish gray (7.5YR 6/2) stratified very fine sand, silt loam, and silty clay loam; common fine prominent light yellowish brown (10YR 6/4) and few medium prominent yellowish brown (10YR 5/6) mottles; massive; very friable; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. It is medium acid to mildly alkaline.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes sand, fine sand, and loamy sand. Some pedons have an A2 horizon.

The B21hir and B3 horizons have hue of 10YR and 7.5YR, value of 3 to 5, and chroma of 3 to 6. They are sand or fine sand. They commonly have small chunks of weakly to strongly cemented ortstein.

The IIC horizon is stratified. Color and texture vary. This horizon is predominantly very fine sand, silt loam, and silty clay loam.

Rousseau series

The Rousseau series consists of moderately well drained and well drained, rapidly permeable soils. These soils are on dunes and beaches of former glacial lakes. They formed in sandy glacial deposits. The slope ranges from 0 to 6 percent. These soils have a slightly higher temperature than that defined for the Rousseau series. This difference does not affect their use or behavior.

Rousseau soils are similar to Pipestone soils. They are adjacent to Pipestone soils but are in slightly lower positions on the landscape. Pipestone soils are wetter than Rousseau soils.

Typical pedon of Rousseau fine sand, 0 to 6 percent slopes, 1,540 feet north and 190 feet west of the SE corner of sec. 35, T. 15 N., R. 3 E.

A1—0 to 4 inches; black (10YR 2/1) fine sand; weak medium granular structure; very friable; many roots; medium acid; abrupt wavy boundary.

A2—4 to 6 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; many roots; medium acid; abrupt wavy boundary.

B21ir—6 to 10 inches; reddish brown (5YR 4/4) fine sand; single grained; loose; many roots; few medium weakly cemented dark reddish brown (5YR 3/3) chunks of ortstein; strongly acid; abrupt wavy boundary.

B22ir—10 to 17 inches; dark yellowish brown (10YR 4/4) fine sand; single grained; loose; many roots; medium acid; clear wavy boundary.

B3—17 to 23 inches; yellowish brown (10YR 5/4) fine sand; single grained; loose; few roots; medium acid; abrupt wavy boundary.

C1—23 to 50 inches; yellowish brown (10YR 5/4) fine sand; single grained; loose; medium acid; abrupt wavy boundary.

C2—50 to 55 inches; dark yellowish brown (10YR 4/4) fine sand; common fine prominent red (2.5YR 4/6) mottles; single grained; loose; medium acid; clear wavy boundary.

C3—55 to 60 inches; yellowish brown (10YR 5/4) fine sand; many fine prominent yellowish red (5YR 5/6) mottles; single grained; loose; medium acid.

The solum ranges from 20 to 32 inches in thickness. It is dominantly fine sand, but it contains some thin layers of loamy fine sand or sand.

The A1 horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 0 to 2. It is 1 to 4 inches thick. In cultivated areas, there is an Ap horizon that has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3. This horizon is 6 to 8 inches thick. In most cultivated areas, there is no A2 horizon.

The B2ir horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 to 6; and chroma of 3 to 8. In some pedons, there is no B3 horizon.

The C horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 to 6; and chroma of 3 to 6.

Sanilac series

The Sanilac series consists of somewhat poorly drained, moderately or moderately slowly permeable soils on low knolls and ridges on till plains modified by lake water. These soils formed in calcareous lacustrine sediment. The slope ranges from 0 to 3 percent. The subsoil in these soils is not gray as defined for the Sanilac series. This difference does not affect the use or behavior of these soils.

Sanilac soils are similar to Bach soils and are adjacent to Bach, Rapson, and Tappan soils. Bach and Tappan soils are wetter than Sanilac soils and are in slightly lower positions on the landscape. Tappan soils are fine-loamy. Rapson soils have sandy material over loamy material, have a spodic horizon, and are in similar positions on the landscape.

Typical pedon of Sanilac very fine sandy loam, in an area of Sanilac-Bach very fine sandy loams, 0 to 3 percent slopes, 1,300 feet east and 849 feet south of the center of sec. 15, T. 15 N., R. 3 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3.2) very fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; few roots; slight effervescence; moderately alkaline; abrupt smooth boundary.

B21—10 to 15 inches; yellowish brown (10YR 5/4) loamy very fine sand; few medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very friable; violent effervescence; moderately alkaline; clear wavy boundary.

B22—15 to 18 inches; light yellowish brown (10YR 6/4) stratified very fine sand and silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; very friable; white (10YR 8/2) lime coatings; violent effervescence; moderately alkaline; clear wavy boundary.

B23—18 to 42 inches; light yellowish brown (10YR 6/4) loamy very fine sand; common medium distinct light gray (10YR 7/2) and few medium distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; very friable; violent effervescence; moderately alkaline; abrupt wavy boundary.

C—42 to 60 inches; reddish brown (5YR 5/3) stratified very fine sand, silt loam, and silty clay loam; common medium prominent yellowish brown (10YR 5/4) and few fine prominent gray (10YR 6/1) mottles; massive; friable; light gray (10YR 7/2) lime coatings; violent effervescence; moderately alkaline.

The solum is 10 to 42 inches thick. Most pedons are calcareous at the surface and all are calcareous within a depth of 10 inches.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. Value for dry soil is 6 or more. This horizon is dominantly very fine sandy loam, but the range includes loam and silt loam. The surface layer ranges from neutral to moderately alkaline.

The B horizon has value of 4 to 6 and chroma of 1 to 4. It has strata of fine sandy loam, very fine sandy loam, silt loam, loamy very fine sand, and very fine sand.

The C horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 to 6; and chroma of 1 to 6. It is stratified very fine sand, loamy very fine sand, silt loam, and silty clay loam. In some pedons, loam and clay loam are below a depth of 40 inches.

Sloan series

The Sloan series consists of very poorly drained, moderately permeable or moderately slowly permeable soils on flood plains. These soils formed in loamy and silty alluvium. The slope is 0 to 1 percent. These soils are shallower to effervescent material and have a higher content of silt than defined in the range for the Sloan series. These differences do not affect their use or behavior.

Sloan soils are similar to Cohoctah soils and are adjacent to Cohoctah and Tappan soils. Cohoctah soils are coarse-loamy and noncalcareous and are in similar positions on the landscape. Tappan soils are fine-loamy, did not form in alluvial material, and are in slightly higher positions on the landscape.

Typical pedon of Sloan loam, 340 feet north and 300 feet west of the SE corner of sec. 7, T. 13 N., R. 5 E.

Ap—0 to 10 inches; black (10YR 2/1) loam; weak very fine granular structure; friable; many roots; slight effervescence; moderately alkaline; abrupt wavy boundary.

A12—10 to 11 inches; very dark grayish brown (10YR 3/2) loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak fine granular structure; friable; common roots; many shell fragments; strong effervescence; moderately alkaline; abrupt wavy boundary.

B21—11 to 17 inches; grayish brown (10YR 5/2) silty clay loam; common fine and medium distinct dark yellowish brown (10YR 4/4) mottles; weak thick and very thick platy structure breaking to weak medium and coarse angular blocky; firm; black (10YR 2/1) organic streaks throughout; strong effervescence; moderately alkaline; gradual wavy boundary.

B22g—17 to 45 inches; gray (10YR 5/1) silt loam; many medium and coarse distinct dark yellowish brown (10YR 4/4) mottles; weak coarse and very coarse platy structure parting to weak medium and coarse angular blocky; firm; black (10YR 2/1) organic streaks in root channels; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg—45 to 60 inches; dark gray (5YR 4/1) silt loam; few fine prominent brown (10YR 4/3) mottles; massive; firm; strong effervescence; moderately alkaline.

Effervescent material is at a depth of 0 to 10 inches. The mollic epipedon is 10 to 24 inches thick.

The Ap and A12 horizons have value of 2 and 3 and chroma of 1 and 2. They are dominantly loam, but the range includes silty clay loam, silt loam, or clay loam. In some pedons, there is no A12 horizon.

The B2g horizon has value of 4 or 5. It is silty clay loam, clay loam, silt loam, or loam. There is some variation in texture because of stratification.

The C horizon is stratified and has variable texture.

Tappan series

The Tappan series consists of poorly drained soils in depressions and drainageways on outwash plains and till plains modified by lake water. These soils formed in calcareous loamy glacial till. The slope is 0 to 1 percent. Permeability is moderate or moderately slow in the subsoil and slow in the substratum.

Tappan soils are similar to Corunna soils and are adjacent to Corunna, Londo, and Poseyville soils. Corunna soils are coarse-loamy and are in similar positions on the landscape. Londo and Poseyville soils are better drained than Tappan soils, have an argillic horizon, and are in slightly higher positions on the landscape.

Typical pedon of Tappan loam, 2,510 feet north and 140 feet east of the SW corner of sec. 7, T. 13 N., R. 5 E.

Ap—0 to 10 inches; very dark gray (10YR 4/1) loam, gray (10YR 5/1) dry; weak fine granular structure; friable; common roots; slight effervescence; moderately alkaline; abrupt smooth boundary.

B1g—10 to 13 inches; dark gray (10YR 4/1) loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine and medium subangular blocky structure; friable; common roots; slight effervescence; moderately alkaline; abrupt wavy boundary.

B2g—13 to 29 inches; gray (10YR 5/1) and dark grayish brown (10YR 4/2) clay loam; many medium prominent yellowish brown (10YR 5/8) mottles; moderate fine and medium subangular blocky structure; firm; few roots; strong effervescence; moderately alkaline; abrupt wavy boundary.

C1g—29 to 34 inches; gray (10YR 5/1) loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; many light gray (10YR 7/1) lime coatings in pores; violent effervescence; moderately alkaline; abrupt wavy boundary.

C2g—34 to 42 inches; gray (10YR 5/1) loam; few fine prominent yellowish brown (10YR 5/6) mottles; massive; firm; violent effervescence; moderately alkaline; abrupt wavy boundary.

C3g—42 to 60 inches; light brownish gray (10YR 6/2) loam; few fine faint gray (10YR 5/1) mottles; massive; firm; violent effervescence; moderately alkaline.

The solum ranges from 11 to 36 inches in thickness. In some pedons, the surface layer, in the upper 10 inches, is mildly alkaline without effervescence. The mollic epipedon ranges from 8 to 14 inches in thickness.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam but the range includes sandy loam and silt loam.

There is no B1g horizon in some pedons. The B2g horizon has value of 4 to 6 and chroma of 1 or 2. It is loam, silty clay loam, or clay loam.

The Cg horizon has value of 4 to 6 and chroma of 1 to 4. It is loam or clay loam.

Tobico series

The Tobico series consists of poorly drained, very rapidly permeable soils in depressions and in drainageways on lake plains, outwash plains, and till plains modified by lake water. These soils formed in sandy glacial drift. The slope is 0 to 1 percent. These soils are deeper to effervescent material than defined in the range for the Tobico series, and they do not have the gray subsoil. These differences, however, do not affect their use or behavior.

Tobico soils are similar to Belleville and Essexville soils and are adjacent to Belleville and Pipestone soils. Belleville and Essexville soils have a thicker surface layer than Tobico soils, are underlain by loamy material between depths of 20 and 40 inches, and are in similar positions on the landscape. Essexville soils are calcareous. Pipestone soils are better drained than Tobico soils, have a spodic horizon, and are in slightly higher positions on the landscape.

Typical pedon of Tobico fine sand, 1,490 feet south and 330 feet west of the NE corner of sec. 35, T. 15 N., R. 4 E.

Ap—0 to 8 inches; very dark gray (10YR 3/1) fine sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common roots; slightly acid; abrupt wavy boundary.

B2—8 to 38 inches; brown (10YR 5/3) fine sand; common fine faint light brownish gray (10YR 6/2) mottles; single grained; loose; common roots; neutral; clear wavy boundary.

C1g—38 to 50 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; few roots; mildly alkaline; clear wavy boundary.

C2g—50 to 60 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; few roots; very slight effervescence; moderately alkaline.

The depth to effervescent material ranges from 15 inches to more than 60 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly fine sand, but the range includes mucky fine sand, loamy sand, loamy fine sand, and fine sandy loam. The horizon is 6 to 10 inches thick. It is slightly acid to mildly alkaline.

Where there is a B2 horizon, it is fine sand, loamy fine sand, or sand. It has hue of 10YR, 2.5YR, or 5YR; value of 3 to 6; and chroma of 0 to 3. It is slightly acid to mildly alkaline.

The C horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 or 5; and chroma of 1 to 3. It is fine sand or sand and ranges from neutral to moderately alkaline.

Wixom series

The Wixom series consists of somewhat poorly drained soils on uplands and on low knolls and ridges on moraines, outwash plains, and till plains modified by lake water. These soils formed in sandy over loamy glacial drift. The slope ranges from 0 to 4 percent. Permeability is rapid in the sandy upper part of the soils and moderately slow in the loamy lower part.

Wixom soils are similar to the Pipestone soil that has a loamy substratum and to Poseyville soils. They are adjacent to Belleville, Essexville, Londo, and Poseyville soils and to the Pipestone soil. The Pipestone soil is sandy throughout its 40-inch control section and is in similar positions on the landscape. Poseyville soils are coarse-loamy, have a sandy upper horizon less than 24 inches thick, do not have a spodic horizon, and are in similar positions on the landscape. Belleville and Essexville soils are wetter than Wixom soils, have a thicker surface layer, do not have a spodic horizon, and are in slightly lower positions on the landscape. Essexville soils are calcareous near the surface. Londo soils are fine-loamy and are in similar positions on the landscape.

Typical pedon of Wixom loamy sand, 0 to 3 percent slopes, 196 feet north, and 1,137 feet east of the SW corner of sec. 5, T. 13 N., R. 4 E.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loamy sand; dark gray (10YR 4/1) dry; weak very fine and fine granular structure; very friable; many roots; neutral; abrupt smooth boundary.

A2—9 to 11 inches; dark grayish brown (10YR 4/2) sand; single grained; loose; common roots; medium acid; abrupt wavy boundary.

B2h—11 to 19 inches; dark reddish brown (5YR 3/2) sand; single grained; loose; few roots; common strongly cemented chunks of ortstein; medium acid; abrupt irregular boundary.

B22ir—19 to 26 inches; dark yellowish brown (10YR 4/4) sand; few fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; few roots; few dark reddish brown (5YR 3/2) weakly cemented chunks of ortstein; slightly acid; abrupt wavy boundary.

IIB23t—26 to 32 inches; brown (10YR 5/3) loam; medium and coarse prominent yellowish brown (10YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; weak and moderate medium and coarse subangular blocky structure; firm; many thin dark grayish brown (10YR 4/2) clay films on faces of peds in pores; neutral; clear wavy boundary.

IIC—32 to 60 inches; brown (10YR 5/3) loam; many medium and coarse prominent yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) mottles; massive; firm; violent effervescence; moderately alkaline.

The depth to the IIB23t horizon ranges from 20 to 40 inches. The sandy part of the solum is medium acid to neutral sand, fine sand, loamy sand, or loamy fine sand. The lower part of the solum and the substratum are loam or clay loam.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is 6 to 10 inches thick. In some pedons, there is no A2 horizon.

In some pedons, there is no B21h horizon. Where there is a B21h horizon, the hue is 10YR, 7.5YR, or 5YR; the value is 3 or 2; and the chroma is 1 to 3. The B22ir horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 or 4; and chroma of 4 or 6. In some pedons, there are small fragments of ortstein in these horizons. The IIB23t horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 2 to 6. Reaction is neutral or mildly alkaline.

The IIC horizon has hue of 10YR, 7.5YR, or 5YR; value of 5 or 6; and chroma of 1 to 4.

Formation of the soils

Soil is formed through the interaction of five major factors: The physical, chemical, and mineralogical composition of the parent material; plant and animal life; climate; relief or topography; and time.

Climate and plant and animal life are the active factors in soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, or horizons. The effects of climate and plant and animal life are modified by relief. The nature of the parent material also affects soil formation. Finally, time is needed to change the parent material into soil. In general, a long time is required for distinct horizons to develop in a soil. The interaction among these factors is more complex for some soils than for others.

Parent material

Parent material is the unconsolidated mass from which soil is formed. The parent materials of the soils in Bay County were deposited by glaciers or by glacial melt water. The last glaciers covered the survey area between 10,000 and 12,000 years ago. Some of the glacial material has been reworked and redeposited by the subsequent action of water and wind. Parent material determines the chemical and mineralogical composition of the soil. Although the parent materials in Bay County are of a common glacial origin, their properties vary greatly, commonly within a short distance, depending on how the materials were deposited. The dominant parent materials in Bay County were deposited as glacial till, lacustrine material, and alluvium.

Glacial till is material that was deposited directly by glaciers. It has been subject to a minimum of water action. Glacial till consists of unsorted particles of varying size. It has small pebbles that have sharp corners, which indicate that the pebbles have not been weathered by water. The glacial till in Bay County, after being deposited by glaciers, was reworked by lake water. Because of the surface geology and the level appearance of the landscape, areas of this glacial till are called lake plains. This glacial till is calcareous and is friable or firm in consistence. It is loam or clay loam. Guelph soils are an example of soils that formed in glacial till. The subsoil of Guelph soils typically is clay loam and has a well developed structure.

Lacustrine material was deposited in still or ponded glacial melt water. It consists of fine soil particles, such as very fine sand and silt loam, that settled out in the still water. It can also consist of coarser particles, mainly fine sands, that settled out along the shorelines or beaches of glacial lakes. The Sanilac soils are an example of soils that formed in lacustrine material deposited in still water. The Pipestone soils are an example of soils that formed in lacustrine material deposited along glacial lake beaches.

Alluvium is material recently deposited by the flood water of streams and rivers. This material varies in texture, depending on the speed of the water from which it was deposited. The Cohoctah and Sloan soils are examples of alluvial soils in Bay County.

Plant and animal life

Green plants have influenced soil formation in Bay County more than any other living organism; however, bacteria, fungi, earthworms, and man have also been an influence. Plants and animals have affected soil formation mainly by adding organic matter and nitrogen to the soil. The kind of organic material in a soil is related to the kinds of plants under which the soil formed. Plant remains accumulate on the surface of the soil, decay, and are added to the soil as organic matter. Plant roots provide channels for the downward movement of water in a soil; also, as they decay, the roots add organic matter. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The native vegetation in Bay County was a combination of deciduous and coniferous trees. Differences in natural soil drainage and in parent material affected the composition of the forest. In general, loamy soils, such as Tappan and Londo soils, were covered mainly by oak and other hardwood trees. The sandy soils, for example, Wixom and Pipestone soils, were covered by white pine and other evergreens.

Climate

Climate determines the kind of plant and animal life on and in the soil. It also determines the amount of water available for the weathering of minerals and for the transporting of soil material. Through its influence on soil temperature, climate determines the rate of chemical reaction in the soil.

The climate in Bay County is cool and humid, probably similar to the climate that prevailed in the survey area when the soils were formed. The climate is uniform throughout the county, except around Saginaw Bay. Differences in climate account for only minor differences among the soils in Bay County.

Relief

Relief, or topography, affects the natural drainage of soils, the rate of erosion, the kind of plant cover, and the soil temperature. In Bay County, the slopes range from 0 to 8 percent. Runoff is most rapid on the steeper slopes. In low areas, water is temporarily ponded.

The soils in Bay County range from excessively drained, on the sandy ridgetops, to very poorly drained, in depressions.

Through its effect on the aeration of the soil, drainage partly determines the color of the soil. Water and air move freely through soils that are well drained and slowly through soils that are very poorly drained. In soils that are well aerated, the iron and aluminum compounds, which give most of the soils their color, are brightly colored and oxidized. In poorly aerated soils, the color is dull gray and mottled. Guelph soils are well aerated soils, and Tappan soils are poorly aerated soils. Guelph and Tappan soils formed in similar parent material.

Time

In general, a long time is required for distinct horizons to develop from parent material. The differences in the length of time that parent material has been in place commonly are reflected in the degree of profile development. Some soils develop rapidly, others slowly.

The soils in Bay County range from young to mature. The glacial deposits in which most of the soils in Bay County formed have been exposed to the agents of soil formation long enough that distinct horizons have developed. The soils that formed in recent alluvial sediment, however, have not been in place long enough for distinct horizons to develop.

Sloan soils are an example of young soils that formed in alluvial material. Londo soils are an example of soils that are old enough that distinct horizons have formed and lime (calcium carbonate) has been leached from the solum.

Processes of soil formation

Soil genesis refers to the processes responsible for the development of soil horizons from unconsolidated parent material. Soil morphology describes the physical, chemical, and biological properties of these horizons.

The soil-forming processes that determined the development of horizons in the soils in Bay County are (1) the accumulation of organic matter, (2) the leaching of lime (calcium carbonate) and other bases, (3) the reduction and transfer of iron, and (4) the formation and translocation of silicate clay minerals. In most of the soils in Bay County, more than one of these processes has been active in the development of horizons.

As organic matter accumulates on the surface of a soil, an A1 horizon is formed. If the soil is plowed, the A1 horizon is mixed into a plow layer, or Ap horizon. In the soils in Bay County, the organic matter content of the surface layer ranges from high to low. For example, Cohoctah soils have a high content of organic matter in the surface layer, and Rousseau soils have a low content.

The leaching of carbonates and other bases has occurred in some soils. The leaching of bases in soils generally precedes the translocation of silicate clay minerals. Several soils in Bay County have been moderately to strongly leached of bases. For example, Pipestone and Rousseau soils generally are leached of carbonates to a depth of more than 60 inches. Many soils have had very little leaching; Essexville, Sanilac, Sloan, and Tappan soils are limy (calcareous) at the surface. These differences in the depth of leaching are determined by the length of time this process has been active.

The reduction and transfer of iron, or gleying, are evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. A gray subsoil indicates the reduction and loss of iron. Tappan soils are an example of soils in which gleying has occurred.

In some soils, the translocation of clay minerals has affected horizon development. This process results in an eluviated (leached) A2 horizon that is lower in clay content and generally lighter in color than the underlying, illuviated (accumulated) B horizon. Clay commonly accumulates in the B horizon as clay films in pores and on the faces of peds. Londo soils are an example of soils in which silicate clay has been translocated and accumulated as clay films in the B horizon. In general, the carbonates and soluble salts are leached from a soil before the silicate clay minerals are translocated.

In some soils in Bay County, for example, Pipestone, Rapson, Rousseau, and Wixom soils, iron, aluminum, and humus have been transferred from the surface layer to 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. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

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 coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

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. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

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. Unstable walls of cuts made by earth-moving equipment. The soil sloughs easily.

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 for 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, as for example in "hillpeats" and "climatic moors."

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 running 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 a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

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.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. 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 an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action. Freezing and thawing of soil moisture. Frost action can damage 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 assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes by water originating mainly from the melting of glacial ice. Many are interbedded or laminated.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Green manure (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, which is the upper limit of saturation.

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.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

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 A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock 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.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

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.

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.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

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. Inadequate strength for supporting 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 greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy 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. 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 mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three single 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.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Outwash plain. A land form of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

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. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the basis of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in 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 a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid 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.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

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.

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.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining 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 grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

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 or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by 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, silt loam, 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. 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 condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Trace elements. The chemical elements in soils, in only extremely small amounts, essential to plant growth. Examples are zinc, cobalt, manganese, copper, and iron.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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 a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1947-76 at Bay City, 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[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	29.8	25.8	22.8	54	-8	0	1.59	.7	2.3	4	11.0
February---	31.9	16.5	24.2	51	-7	0	1.29	.5	2.0	4	8.4
March------	40.2	24.5	32.4	70	2	6	2.29	1.2	3.2	5	6.7
April------	55.7	36.3	46.0	82	19	71	2.63	1.6	3.6	6	1.3
May--------	67.7	46.1	56.9	88	29	254	2.62	1.8	3.4	7	T
June-------	78.5	57.0	67.7	95	39	539	3.01	1.7	4.2	6	T
July-------	82.2	61.1	71.7	95	47	679	2.66	1.4	3.8	6	0
August-----	80.4	59.6	70.0	96	43	627	2.80	1.4	4.0	6	0
September--	72.3	52.2	62.2	91	33	380	2.65	1.5	3.6	6	0
October----	61.9	42.8	52.3	83	24	156	2.37	1.0	3.6	5	.2
November---	46.1	32.1	39.1	70	9	17	2.20	1.3	3.0	6	3.6
December---	33.9	21.3	27.6	60	-2	0	1.76	.8	2.6	4	8.5
Year-----	56.7	38.8	47.7	98	-10	2,729	27.87	23.8	31.8	66	39.6

[1]A growing degree day is an index of the amount 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° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1930-74 at Bay City, 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--	April 22	April 30	May 15
2 years in 10 later than--	April 16	April 26	May 11
5 years in 10 later than--	April 6	April 18	May 2
First freezing temperature in fall:			
1 year in 10 earlier than--	October 27	October 13	September 30
2 years in 10 earlier than--	November 1	October 19	October 5
5 years in 10 earlier than--	November 12	October 31	October 16

TABLE 3.--GROWING SEASON

[Recorded in the period 1930-74 at Bay City, 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	193	175	147
8 years in 10	202	182	153
5 years in 10	219	196	167
2 years in 10	236	209	180
1 year in 10	245	216	187

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
12	Corunna-Tappan sandy loams	7,345	2.5
13	Belleville loamy sand	16,980	5.9
16	Essexville loamy sand	4,130	1.4
17A	Wixom loamy sand, 0 to 3 percent slopes	24,850	8.6
23	Tappan loam	84,600	29.4
25A	Pipestone fine sand, loamy substratum, 0 to 3 percent slopes	5,805	2.0
31	Sloan loam	1,415	0.5
35A	Pipestone fine sand, 0 to 3 percent slopes	13,660	4.7
37B	Rousseau fine sand, 0 to 6 percent slopes	5,060	1.8
43A	Londo loam, 0 to 1 percent slopes	33,370	11.6
49A	Londo-Poseyville complex, 0 to 3 percent slopes	26,500	9.2
50	Cohoctah loamy fine sand	3,005	1.0
51	Urban land	2,560	0.9
52	Urban land-Tappan complex	3,830	1.3
53A	Urban land-Londo complex, 0 to 1 percent slopes	2,105	0.7
54B	Urban land-Rousseau complex, 0 to 6 percent slopes	450	0.2
55	Aquents, sandy and loamy	3,810	1.3
56	Dumps	545	0.2
57A	Poseyville loamy sand, 0 to 3 percent slopes	4,345	1.5
58A	Tappan-Poseyville complex, 0 to 3 percent slopes	19,990	6.9
59	Tobico fine sand	6,090	2.1
60	Urban land-Essexville complex	1,435	0.5
61	Cohoctah fine sandy loam	1,135	0.4
62A	Sanilac-Bach very fine sandy loams, 0 to 3 percent slopes	1,345	0.5
63A	Rapson-Bach complex, 0 to 3 percent slopes	1,765	0.6
64B	Londo-Wixom complex, 0 to 4 percent slopes	4,095	1.4
65B	Guelph-Menominee complex, 2 to 8 percent slopes	2,480	0.9
66A	Pipestone-Tobico fine sands, 0 to 3 percent slopes	3,685	1.3
67	Belleville loamy sand, ponded	1,250	0.4
	Water	1,005	0.3
	Total	288,640	100.0

TABLE 5.--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	Corn	Winter wheat	Soybeans	Dry beans	Sugar beets	Irish potatoes	Alfalfa hay
	Bu	Bu	Bu	Bu	Ton	Cwt	Ton
12 Corunna-Tappan	125	60	40	35	22	200	5.2
13 Belleville	105	50	33	23	18	300	4.5
16 Essexville	100	45	32	26	18	300	4.5
17A Wixom	95	45	35	25	16	---	5.4
23 Tappan	125	60	42	35	20	---	5.5
25A Pipestone	80	35	25	22	14	---	3.9
31 Sloan	---	---	---	---	---	---	---
35A Pipestone	65	35	23	20	---	---	3.7
37B Rousseau	50	25	---	---	---	---	3.3
43A Londo	120	60	45	35	20	---	---
49A Londo-Poseyville	111	57	38	31	19	---	4.9
50 Cohoctah	---	---	---	---	---	---	---
51 Urban land	---	---	---	---	---	---	---
52 Urban land-Tappan	---	---	---	---	---	---	---
53A Urban land-Londo	---	---	---	---	---	---	---
54B Urban land-Rousseau	---	---	---	---	---	---	---
55 Aquents	---	---	---	---	---	---	---
56 Dumps	---	---	---	---	---	---	---
57A Poseyville	95	50	35	29	18	---	4.7
58A Tappan-Poseyville	115	50	39	33	21	---	5.1
59 Tobico	70	35	23	20	---	200	3.9

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn	Winter wheat	Soybeans	Dry beans	Sugar beets	Irish potatoes	Alfalfa hay
	Bu	Bu	Bu	Bu	Ton	Cwt	Ton
60 Urban land-Essexville	---	---	---	---	---	---	---
61 Cohoctah	100	40	35	30	17	200	4.5
62A Sanilac-Bach	118	51	38	32	20	---	4.9
63A Rapson-Bach	105	41	35	30	18	---	4.6
64B Londo-Wixom	100	40	33	27	18	---	4.7
65B Guelph-Menominee	96	48	32	26	17	---	4.6
66A Pipestone-Tobico	64	32	27	22	---	---	3.8
67 Belleville	---	---	---	---	---	---	---

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	---	---	---	---
II	184,070	2,480	181,590	---
III	73,670	---	68,610	5,060
IV	7,055	---	7,055	---
V	5,425	---	5,425	---
VI	---	---	---	---
VII	---	---	---	---
VIII	---	---	---	---

TABLE 7.--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	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
12*:								
Corunna	3w	Slight	Severe	Moderate	Moderate	Red maple	56	Eastern cottonwood,
						White ash	56	white ash,
						American basswood	56	eastern white pine,
						Silver maple	82	American sycamore,
						American sycamore	---	Northern white-cedar,
						Pin oak	---	Norway spruce,
						Swamp white oak	---	Carolina poplar.
Tappan	2w	Slight	Severe	Moderate	Moderate	Red maple	66	White spruce,
						Silver maple	---	eastern white pine,
						Pin oak	---	green ash,
						White ash	---	eastern cottonwood.
						American basswood	---	
						Quaking aspen	---	
13 Belleville	5w	Slight	Severe	Moderate	Moderate	Silver maple	64	Black spruce,
						Red maple	39	white spruce.
						Tamarack	34	
						Pin oak	---	
						Swamp white oak	---	
16 Essexville	5w	Slight	Severe	Severe	Severe	Red maple	40	White spruce,
						Pin oak	---	paper birch,
						Eastern cottonwood	75	red maple,
						American basswood	40	green ash,
						Swamp white oak	---	American sycamore,
						Red maple	40	eastern white pine,
						Green ash	40	eastern cottonwood,
						Bur oak	---	Austrian pine,
						Silver maple	64	Scotch pine.
17A Wixom	3s	Slight	Slight	Severe	Slight	Quaking aspen	60	Eastern white pine,
						American beech	---	Norway spruce,
						White oak	---	black cherry,
						Red maple	56	red maple,
						Sugar maple	53	American basswood.
						Black oak	---	
						American basswood	56	
23 Tappan	2w	Slight	Severe	Moderate	Moderate	Red maple	66	White spruce,
						Silver maple	---	eastern white pine,
						Pin oak	---	green ash,
						White ash	---	eastern cottonwood.
						American basswood	---	
						Quaking aspen	---	
25A Pipestone	3s	Slight	Slight	Moderate	Slight	Red maple	56	White spruce,
						White ash	56	eastern cottonwood,
						Bitternut hickory	---	eastern white pine,
						Common hackberry	---	Norway spruce,
						American basswood	56	Austrian pine.
						Eastern cottonwood	91	
31 Sloan	2w	Slight	Severe	Severe	Severe	Pin oak	85	Norway spruce,
						Swamp white oak	---	red maple,
						Red maple	---	white ash.
35A Pipestone	3s	Slight	Slight	Severe	Slight	Red maple	56	White spruce,
						White ash	56	eastern cottonwood,
						Eastern cottonwood	91	eastern white pine,
						Bitternut hickory	---	Norway spruce,
						Common hackberry	---	Austrian pine.
						American basswood	56	

See footnote at end of table.

TABLE 7.--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	
37B----------------- Rousseau	2s	Slight	Slight	Severe	Slight	Sugar maple--------- Red maple----------- Balsam fir---------- Northern red oak---- Eastern white pine-- Red pine------------ Jack pine----------- Black oak-----------	61 --- --- 70 65 65 55 66	Red pine, jack pine, white spruce.
43A----------------- Londo	2o	Slight	Slight	Slight	Slight	Green ash----------- Northern red oak---- Black oak----------- Red maple----------- American basswood--- Eastern cottonwood-- White ash-----------	66 66 --- 66 66 101 65	White spruce, eastern cottonwood, Norway spruce, black spruce, eastern white pine, Austrian pine.
49A*:								
Londo--------------	2o	Slight	Slight	Slight	Slight	Green ash----------- Northern red oak---- Black oak----------- Red maple----------- American basswood--- Eastern cottonwood-- White ash-----------	66 66 --- 66 66 101 65	White spruce, eastern cottonwood, Norway spruce, black spruce, eastern white pine, Austrian pine.
Poseyville---------	3s	Slight	Slight	Moderate	Slight	Northern red oak---- Sugar maple--------- American basswood--- Eastern cottonwood-- Bigtooth aspen------	56 53 56 91 60	White spruce, Austrian pine, eastern cottonwood, red maple, sugar maple, northern red oak.
50------------------ Cohoctah	3w	Slight	Severe	Severe	Severe	Red maple----------- Eastern cottonwood-- Silver maple-------- White ash----------- Swamp white oak----- American sycamore--- Pin oak------------- Bitternut hickory---	56 91 82 66 --- --- --- ---	Eastern cottonwood, American sycamore, Austrian pine, Carolina poplar, red maple, swamp white oak, pin oak.
57A----------------- Poseyville	3s	Slight	Slight	Moderate	Slight	Northern red oak---- Sugar maple--------- American basswood--- Eastern cottonwood-- Bigtooth aspen------	56 53 56 91 60	White spruce, Austrian pine, eastern cottonwood, red maple, sugar maple, northern red oak.
58A*:								
Tappan-------------	2w	Slight	Severe	Moderate	Moderate	Red maple----------- Silver maple-------- Pin oak------------- White ash----------- American basswood--- Quaking aspen-------	66 --- --- --- --- ---	White spruce, eastern white pine, green ash, eastern cottonwood.
Poseyville---------	3s	Slight	Slight	Moderate	Slight	Northern red oak---- Sugar maple--------- American basswood--- Eastern cottonwood-- Bigtooth aspen------	56 53 56 91 60	White spruce, Austrian pine, eastern cottonwood, red maple, sugar maple, northern red oak.

See footnote at end of table.

TABLE 7.--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	Trees to plant
59 Tobico	5w	Slight	Severe	Severe	Severe	Red maple	40	
						White ash	40	
						Pin oak	---	
						Eastern cottonwood	75	
						American sycamore	---	
						Swamp white oak	---	
61 Cohoctah	3w	Slight	Severe	Severe	Severe	Red maple	56	White spruce,
						Eastern cottonwood	91	American sycamore,
						Silver maple	82	Austrian pine,
						White ash	66	Carolina poplar,
						Swamp white oak	---	red maple,
						American sycamore	---	swamp white oak,
						Pin oak	---	pin oak.
						Bitternut hickory	---	
62A*:								
Sanilac	2o	Slight	Slight	Slight	Slight	Northern red oak	66	White spruce,
						Red maple	66	eastern white pine,
						White ash	66	eastern cottonwood,
						Sugar maple	61	Norway spruce,
						Silver maple	91	northern white-cedar,
						American basswood	66	Austrian pine.
						Pin oak	---	
Bach	2w	Slight	Severe	Severe	Severe	Red maple	66	Northern white-cedar,
						Bur oak	66	eastern white pine,
						White ash	66	eastern cottonwood,
						Black ash	---	Austrian pine,
						Swamp white oak	66	red maple,
						Silver maple	91	Scotch pine.
63A*:								
Rapson	3s	Slight	Slight	Moderate	Slight	Red maple	56	Austrian pine,
						White oak	56	eastern white pine,
						Eastern cottonwood	91	white spruce,
						Common hackberry	---	northern white-cedar,
						Bitternut hickory	---	eastern cottonwood.
						Swamp white oak	---	
Bach	2w	Slight	Severe	Severe	Severe	Red maple	66	Northern white-cedar,
						Bur oak	66	eastern white pine,
						White ash	66	eastern cottonwood,
						Black ash	---	Austrian pine,
						Swamp white oak	66	red maple,
						Silver maple	91	Scotch pine.
64B*:								
Londo	2o	Slight	Slight	Slight	Slight	Green ash	66	White spruce,
						Northern red oak	66	eastern cottonwood,
						Black oak	---	Norway spruce,
						Red maple	66	black spruce,
						American basswood	66	eastern white pine,
						Eastern cottonwood	101	Austrian pine.
						White ash	65	
Wixom	3s	Slight	Slight	Severe	Slight	Quaking aspen	60	Eastern white pine,
						American beech	---	Norway spruce,
						White oak	---	black cherry,
						Red maple	56	red maple,
						Sugar maple	53	American basswood.
						Black oak	---	
						American basswood	56	

See footnote at end of table.

TABLE 7.--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	
65B*:								
Guelph	2o	Slight	Slight	Slight	Slight	Sugar maple	61	White spruce, eastern white pine, black walnut, yellow-poplar.
						Northern red oak	---	
						Eastern white pine	---	
						Black walnut	---	
						White oak	---	
						Black cherry	---	
						Red pine	---	
Menominee	2s	Slight	Slight	Moderate	Slight	Sugar maple	61	Red pine, black walnut.
						Quaking aspen	---	
						Red pine	---	
						Silver maple	---	
						Paper birch	---	
						Yellow birch	---	
						American basswood	---	
						Black cherry	---	
66A*:								
Pipestone	3s	Slight	Slight	Severe	Slight	Red maple	56	White spruce, eastern cottonwood, eastern white pine, Norway spruce, Austrian pine.
						White ash	56	
						Eastern cottonwood	91	
						Bitternut hickory	---	
						Common hackberry	---	
						American basswood	56	
Tobico	5w	Slight	Severe	Severe	Severe	Red maple	40	
						White ash	40	
						Pin oak	---	
						Eastern cottonwood	75	
						American sycamore	---	
						Swamp white oak	---	

* This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the soils.

TABLE 8.--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 heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
12*: Corunna.					
Tappan	---	Arrowwood, Amur privet, silky dogwood.	Northern white-cedar, eastern white pine.	---	Green ash, Carolina poplar.
13 Belleville	---	Silky dogwood, Amur privet, Austrian pine, white spruce.	Northern white-cedar, eastern white pine, Norway spruce.	---	Carolina poplar, green ash.
16 Essexville	---	Amur privet, Austrian pine, hawthorn, silky dogwood.	Eastern white pine, Norway spruce, northern white-cedar.	---	Carolina poplar, green ash.
17A Wixom	---	Silky dogwood, Amur privet.	Eastern white pine, northern white-cedar, Austrian pine.	Norway spruce	Green ash, Carolina poplar.
23 Tappan	---	Arrowwood, Amur privet, silky dogwood.	Northern white-cedar, eastern white pine.	---	Green ash, Carolina poplar.
25A Pipestone	---	American cranberrybush, Tatarian honeysuckle.	White spruce, Austrian pine, northern white-cedar.	---	Green ash, Carolina poplar.
31 Sloan	---	Redosier dogwood, silky dogwood, gray dogwood.	Northern white-cedar, black willow, European alder.	---	---
35A Pipestone	---	American cranberrybush, Tatarian honeysuckle.	White spruce, Austrian pine, northern white-cedar.	---	Carolina poplar.
37B Rousseau	Vanhoutte spirea	White spruce, Tatarian honeysuckle, autumn-olive.	Austrian pine, Norway spruce.	Red pine, jack pine.	Carolina poplar.
43A Londo	---	Amur privet, eastern redcedar.	White spruce, northern white-cedar, black spruce, blue spruce.	---	Carolina poplar, green ash.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
49A*:					
Londo	---	Amur privet, eastern redcedar.	White spruce, northern white-cedar, black spruce, blue spruce.	---	Carolina poplar, green ash.
Poseyville	---	American cranberrybush, blue spruce, Tatarian honeysuckle.	Austrian pine, eastern white pine, European larch.	---	Green ash, Carolina poplar.
50 Cohoctah	---	Amur privet, silky dogwood, Austrian pine.	Northern white-cedar, Siberian crabapple, white spruce.	---	Green ash, Carolina poplar.
51. Urban land					
52*: Urban land.					
Tappan	---	Arrowwood, Amur privet, silky dogwood.	Northern white-cedar, eastern white pine.	Green ash	Carolina poplar.
53A*: Urban land.					
Londo	---	Amur privet, eastern redcedar.	White spruce, northern white-cedar, black spruce, blue spruce.	---	Carolina poplar, green ash.
54B*: Urban land.					
Rousseau	Vanhoutte spirea	White spruce, Tatarian honeysuckle, autumn-olive.	Austrian pine, Norway spruce, eastern redcedar.	Red pine, jack pine.	Carolina poplar.
55. Aquents					
56. Dumps					
57A Poseyville	---	American cranberrybush, blue spruce, Tatarian honeysuckle.	Austrian pine, eastern white pine, European larch.	Norway spruce	Green ash, Carolina poplar.
58A*:					
Tappan	---	Arrowwood, Amur privet, silky dogwood.	Northern white-cedar, eastern white pine.	---	Green ash, Carolina poplar.
Poseyville	---	Tatarian honeysuckle, white spruce.	Austrian pine, eastern white pine, European larch.	Norway spruce	Green ash, Carolina poplar.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
59: Tobico	---	Silky dogwood, white spruce.	Northern white-cedar.	---	Carolina poplar.
60*: Urban land.					
Essexville	---	Amur privet, Austrian pine, hawthorn, silky dogwood.	Eastern white pine, Norway spruce, northern white-cedar.	---	Carolina poplar, green ash.
61: Cohoctah	---	Amur privet, silky dogwood.	Northern white-cedar, Siberian crabapple, white spruce.	---	Green ash, Carolina poplar.
62A*: Sanilac	---	Late lilac, silky dogwood.	White spruce, northern white-cedar, Austrian pine, Siberian crabapple.	Eastern white pine.	Carolina poplar.
Bach	---	Silky dogwood, whitebelle honeysuckle, late lilac.	Green ash, northern white-cedar.	---	Carolina poplar.
63A*: Rapson	---	Blue spruce, Tatarian honeysuckle, silky dogwood, American cranberrybush.	Austrian pine, eastern white pine, northern white-cedar.	Norway spruce	Carolina poplar.
Bach	---	Silky dogwood, whitebelle honeysuckle, late lilac.	Green ash, northern white-cedar.	---	Carolina poplar.
64B*: Londo	---	Amur privet, eastern redcear.	White spruce, northern white-cedar, black spruce, blue spruce, European larch.	---	Carolina poplar, green ash.
Wixom	---	Silky dogwood, Amur privet.	Eastern white pine, northern white-cedar.	Norway spruce	Green ash, Carolina poplar.
65B*: Guelph	---	Tatarian honeysuckle, autumn-olive, late lilac, Amur privet, Persian lilac, silky dogwood.	Eastern white pine, Norway spruce, Austrian pine.	Scotch pine	Carolina poplar.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
65B*:					
Menominee--------	---	Amur honeysuckle, white spruce, blue spruce.	Red pine, jack pine.	---	Red maple.
66A*:					
Pipestone--------	---	American cranberrybush, Tatarian honeysuckle.	White spruce, Austrian pine, northern white-cedar.	---	Carolina poplar.
Tobico-----------	---	Silky dogwood, white spruce.	Northern white-cedar.	---	Carolina poplar.
67. Belleville					

* This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--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]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
12*:						
Corunna	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
Tappan	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
13 Belleville	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.	Severe: floods, wetness.
16 Essexville	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: wetness, floods.
17A Wixom	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: too sandy, wetness.
23 Tappan	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
25A Pipestone	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Severe: wetness, too sandy.
31 Sloan	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
35A Pipestone	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.
37B Rousseau	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Severe: too sandy.
43A Londo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Moderate: wetness.
49A*:						
Londo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Moderate: wetness.
Poseyville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: too sandy, wetness.
50 Cohoctah	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.	Severe: floods, wetness.
51. Urban land						

See footnote at end of table.

TABLE 9.--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
52*:						
Urban land.						
Tappan	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
53A*:						
Urban land.						
Londo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Moderate: wetness.
54B*:						
Urban land.						
Rousseau	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Severe: too sandy.
55. Aquents						
56. Dumps						
57A Poseyville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: too sandy, wetness.
58A*:						
Tappan	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness, floods.
Poseyville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: too sandy, wetness.
59 Tobico	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
60*:						
Urban land.						
Essexville	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, percs slowly.	Severe: wetness, floods.
61 Cohoctah	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.	Severe: wetness.
62A*:						
Sanilac	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Bach	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.	Severe: wetness, floods.

See footnote at end of table.

TABLE 9.--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
63A*:						
Rapson	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness.
Bach	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.	Severe: wetness, floods.
64B*:						
Londo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Moderate: wetness.
Wixom	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: too sandy, wetness.
65B*:						
Guelph	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: low strength, frost action.	Slight.
Menominee	Moderate: wetness.	Moderate: shrink-swell.	Moderate: shrink-swell, wetness.	Moderate: slope, shrink-swell.	Slight	Moderate: too sandy.
66A*:						
Pipestone	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.
Tobico	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
67 Belleville	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.

* This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "poor," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
12*:					
Corunna	Severe: wetness, percs slowly, floods.	Severe: wetness, seepage.	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Poor: wetness.
Tappan	Severe: wetness, percs slowly, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
13 Belleville	Severe: wetness, percs slowly, floods.	Severe: wetness, seepage.	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Poor: wetness.
16 Essexville	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, seepage, wetness.	Poor: wetness.
17A Wixom	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
23 Tappan	Severe: wetness, percs slowly, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
25A Pipestone	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, seepage, wetness.
31 Sloan	Severe: wetness, floods, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
35A Pipestone	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage, wetness.
37B Rousseau	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness. too sandy.	Severe: seepage, wetness.	Poor: too sandy, seepage.
43A Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
49A*:					
Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Poseyville	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.

See footnote at end of table.

TABLE 10.--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
50: Cohoctah	Severe: wetness, floods.	Severe: floods, seepage, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Poor: wetness.
51. Urban land					
52*: Urban land.					
Tappan	Severe: wetness, percs slowly, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
53A*: Urban land.					
Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
54B*: Urban land.					
Rousseau	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: too sandy, seepage.
55. Aquents					
56. Dumps					
57A: Poseyville	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
58A*: Tappan	Severe: wetness, percs slowly, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Poseyville	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
59: Tobico	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Poor: wetness, seepage, too sandy.
60*: Urban land.					
Essexville	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
61: Cohoctah	Severe: wetness, floods.	Severe: floods, seepage, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Poor: wetness.

See footnote at end of table.

TABLE 10.--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
62A*:					
Sanilac	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Bach	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Poor: wetness.
63A*:					
Rapson	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, too sandy.	Severe: wetness, seepage.	Poor: too sandy, wetness.
Bach	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, floods.	Severe: wetness, flood, seepage.	Poor: wetness.
64B*:					
Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Wixom	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
65B*:					
Guelph	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
Menominee	Severe: percs slowly, wetness.	Severe: seepage, wetness.	Moderate: too clayey, wetness.	Severe: seepage.	Poor: too sandy, seepage.
66A*:					
Pipestone	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage, wetness.
Tobico	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Poor: wetness, seepage, too sandy.
67 Belleville	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.

* This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
12*:				
Corunna	Poor: wetness.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: wetness.
Tappan	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
13 Belleville	Poor: wetness, low strength.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: wetness.
16 Essexville	Poor: wetness, low strength.	Poor: thin layer.	Unsuited: excess fines.	Poor: wetness.
17A Wixom	Poor: low strength, wetness.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
23 Tappan	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
25A Pipestone	Poor: wetness.	Good	Unsuited: excess fines.	Poor: too sandy, wetness.
31 Sloan	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
35A Pipestone	Poor: wetness.	Good	Unsuited: excess fines.	Poor: too sandy, wetness.
37B Rousseau	Good	Good	Unsuited: excess fines.	Poor: too sandy.
43A Londo	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
49A*:				
Londo	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Poseyville	Poor: low strength, wetness.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
50 Cohoctah	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
51. Urban land				
52*:				
Urban land.				
Tappan	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
53A*:				
Urban land.				

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand.	Gravel	Topsoil
53A*:				
Londo	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
54B*:				
Urban land.				
Rousseau	Good	Good	Unsuited: excess fines.	Poor: too sandy.
55. Aquents				
56. Dumps				
57A Poseyville	Poor: low strength, wetness.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
58A*:				
Tappan	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Poseyville	Poor: low strength, wetness.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
59 Tobico	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness, too sandy.
60*:				
Urban land.				
Essexville	Poor: wetness, low strength.	Poor: thin layer.	Unsuited: excess fines.	Poor: wetness.
61 Cohoctah	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
62A*:				
Sanilac	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bach	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
63A*:				
Rapson	Poor: wetness.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
Bach	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
64B*:				
Londo	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Wixom	Poor: low strength, wetness.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
65B*:				
Guelph	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
65B*:				
Menominee	Poor: thin layer.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
66A*:				
Pipestone	Poor: wetness.	Good	Unsuited: excess fines.	Poor: too sandy, wetness.
Tobico	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness, too sandy.
67 Belleville	Poor: wetness, low strength.	Poor: thin layer.	Unsuited: excess fines.	Poor: wetness.

* This map unit is made up of two or more dominant kinds of soils. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
12*:						
Corunna	Wetness	Slow refill	Floods, frost action.	Wetness, floods, soil blowing.	Not needed	Wetness.
Tappan	Wetness	Slow refill	Percs slowly, floods, frost action.	Wetness, soil blowing, percs slowly.	Not needed	Wetness, percs slowly.
13 Belleville	Wetness	Slow refill	Floods, frost action.	Wetness, fast intake, soil blowing.	Not needed	Wetness.
16 Essexville	Wetness	Slow refill	Frost action, floods.	Wetness, fast intake, soil blowing.	Not needed	Wetness.
17A Wixom	Wetness	Slow refill	Favorable	Fast intake, soil blowing, wetness.	Too sandy, wetness, erodes easily.	Wetness, erodes easily.
23 Tappan	Wetness	Slow refill	Percs slowly, floods, frost action.	Wetness, percs slowly.	Not needed	Wetness, percs slowly.
25A Pipestone	Seepage, piping.	Slow refill	Favorable	Fast intake, wetness, droughty.	Too sandy, wetness, soil blowing.	Droughty, wetness.
31 Sloan	Piping, wetness.	Slow refill	Floods, frost action.	Wetness, floods.	Not needed	Wetness, erodes easily.
35A Pipestone	Seepage, piping, wetness.	Favorable	Favorable	Fast intake, wetness, droughty.	Too sandy, soil blowing, wetness.	Droughty, wetness.
37B Rousseau	Seepage, piping.	No water	Not needed	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
43A Londo	Wetness	Slow refill	Frost action	Wetness	Not needed	Wetness.
49A*:						
Londo	Wetness	Slow refill	Frost action	Wetness	Wetness	Wetness.
Poseyville	Wetness	Slow refill	Frost action	Wetness, fast intake, soil blowing.	Soil blowing, wetness.	Wetness, erodes easily.
50 Cohoctah	Piping, wetness.	Favorable	Floods, frost action.	Wetness, fast intake, soil blowing.	Not needed	Wetness.
51. Urban land						
52*: Urban land.						
Tappan	Wetness	Slow refill	Percs slowly, floods, frost action.	Wetness, percs slowly.	Not needed	Wetness, percs slowly.
53A*: Urban land.						

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
53A*:						
Londo	Wetness	Slow refill	Frost action	Wetness	Wetness	Wetness.
54B*:						
Urban land.						
Rousseau	Seepage, piping.	No water	Not needed	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
55. Aquents						
56. Dumps						
57A Poseyville	Wetness	Slow refill	Frost action	Wetness, fast intake, soil blowing.	Soil blowing, wetness.	Wetness, erodes easily.
58A*:						
Tappan	Wetness	Slow refill	Percs slowly, floods, frost action.	Wetness, percs slowly, floods.	Not needed	Wetness, percs slowly.
Poseyville	Wetness	Slow refill	Frost action	Wetness, fast intake, soil blowing.	Soil blowing, wetness.	Wetness, erodes easily.
59 Tobico	Seepage, piping, wetness.	Favorable	Floods	Fast intake, droughty, wetness.	Not needed	Wetness, droughty.
60*:						
Urban land.						
Essexville	Wetness	Slow refill	Frost action, floods.	Wetness, fast intake, soil blowing.	Not needed	Wetness.
61 Cohoctah	Piping, wetness.	Favorable	Floods, frost action.	Wetness, soil blowing.	Not needed	Wetness.
62A*:						
Sanilac	Wetness	Slow refill	Frost action	Wetness, erodes easily, soil blowing.	Wetness, soil blowing.	Erodes easily, wetness.
Bach	Piping, wetness.	Slow refill	Frost action, floods.	Wetness, soil blowing, floods.	Not needed	Wetness.
63A*:						
Rapson	Piping, wetness.	Slow refill	Favorable	Fast intake, soil blowing, wetness.	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
Bach	Piping, wetness.	Slow refill	Frost action, floods.	Wetness, soil blowing, floods.	Not needed	Wetness.
64B*:						
Londo	Wetness	Slow refill	Frost action	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
Wixom	Wetness	Slow refill	Favorable	Fast intake, soil blowing, wetness.	Too sandy, wetness, erodes easily.	Wetness, erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
65B*:						
Guelph	Wetness	Deep to water, slow refill.	Favorable	Wetness	Wetness	Favorable.
Menominee	Seepage, wetness.	Slow refill, deep to water.	Favorable	Droughty, fast intake, wetness.	Too sandy, wetness.	Droughty.
66A*:						
Pipestone	Seepage, piping, wetness.	Favorable	Favorable	Fast intake, wetness, droughty.	Too sandy, soil blowing, wetness.	Droughty, wetness.
Tobico	Seepage, piping, wetness.	Favorable	Floods	Fast intake, droughty, wetness.	Not needed	Wetness, droughty.
67 Belleville	Wetness	Slow refill	Floods, frost action.	Wetness, floods.	Not needed	Wetness.

* This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
12*:					
Corunna	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
Tappan	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
13 Belleville	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
16 Essexville	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.
17A Wixom	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.
23 Tappan	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
25A Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: too sandy.	Severe: wetness, too sandy.
31 Sloan	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
35A Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: too sandy.	Severe: wetness, too sandy.
37B Rousseau	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
43A Londo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
49A*:					
Londo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Poseyville	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.
50 Cohoctah	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
51. Urban land					
52*: Urban land.					

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
52*:					
Tappan	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
53A*: Urban land.					
Londo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
54B*: Urban land.					
Rousseau	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
55. Aquents					
56. Dumps					
57A Poseyville	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.
58A*:					
Tappan	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
Poseyville	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.
59 Tobico	Severe: floods, wetness, too sandy.	Severe: wetness, too sandy.	Severe: wetness, floods, too sandy.	Severe: too sandy, wetness.	Severe: too sandy, wetness, floods.
60*: Urban land.					
Essexville	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.
61 Cohoctah	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
62A*:					
Sanilac	Severe: wetness.	Moderate: wetness, dusty.	Severe: wetness.	Moderate: wetness, dusty.	Moderate: wetness.
Bach	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
63A*: Rapson.					

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
63A*:					
Bach	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
64B*:					
Londo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Wixom	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.
65B*:					
Guelph	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight	Slight.
Menominee	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Moderate: too sandy.
66A*:					
Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: too sandy.	Severe: wetness, too sandy.
Tobico	Severe: floods, wetness, too sandy.	Severe: wetness, too sandy.	Severe: wetness, floods, too sandy.	Severe: too sandy, wetness.	Severe: wetness, floods.
67 Belleville	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.

* This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WILDLIFE HABITAT POTENTIALS

[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
12*:										
Corunna	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Tappan	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
13 Belleville	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Fair.
16 Essexville	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Fair.
17A Wixom	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
23 Tappan	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
25A Pipestone	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
31 Sloan	Very poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
35A Pipestone	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor.
37B Rousseau	Poor	Poor	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Poor.
43A Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
49A*:										
Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Poseyville	Poor	Fair	Good	Good	Good	Fair	Good	Fair	Good	Fair.
50 Cohoctah	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
51. Urban land										
52*: Urban land.										
Tappan	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
53A*: Urban land.										
Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
54B*: Urban land.										
Rousseau	Poor	Poor	Good	Fair	Fai·	Poor	Very poor.	Fair	Fair	Poor.
55. Aquents										

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--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
56. Dumps										
57A Poseyville	Poor	Fair	Good	Good	Good	Fair	Good	Fair	Good	Fair.
58A*:										
Tappan	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Poseyville	Poor	Fair	Good	Good	Good	Fair	Good	Fair	Good	Fair.
59 Tobico	Very poor.	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
60*: Urban land.										
Essexville	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Fair.
61 Cohoctah	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
62A*:										
Sanilac	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
Bach	Good	Good	Poor	Poor	Poor	Good	Good	Good	Poor	Good.
63A*:										
Rapson	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Fair	Fair.
Bach	Good	Good	Poor	Poor	Poor	Good	Good	Good	Poor	Good.
64B*:										
Londo	Fair	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
Wixom	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
65B*:										
Guelph	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Menominee	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
66A*:										
Pipestone	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor.
Tobico	Very poor.	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
67 Belleville	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.

* This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[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		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
12*:											
Corunna	0-10	Sandy loam	SM, ML, SC, CL	A-2, A-4	0-5	95-100	95-100	65-85	25-70	<30	NP-10
	10-29	Sandy loam, loamy sand.	SM, SC, SM-SC	A-4, A-2	0-5	95-100	95-100	50-75	15-40	<30	NP-10
	29-60	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	70-90	25-50	11-25
Tappan	0-10	Sandy loam	SM, SC, SM-SC	A-2, A-4	0-5	90-100	90-95	65-95	30-50	<25	NP-10
	10-29	Loam, clay loam	CL	A-6	0-5	90-100	90-95	85-95	55-80	20-40	10-25
	29-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	90-100	90-95	85-95	55-75	20-35	5-15
13 Belleville	0-11	Loamy sand	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
	11-36	Sand, loamy sand, loamy fine sand.	SM	A-2	0-3	95-100	90-100	50-85	15-30	<20	NP-4
	36-60	Clay loam, silty clay loam, loam	CL	A-6, A-7	0-3	95-100	90-100	90-100	70-90	25-50	10-25
16 Essexville	0-11	Loamy sand	SM, SM-SC	A-2, A-4	0	100	95-100	50-85	15-45	<20	NP-7
	11-26	Loamy fine sand, fine sand, sand.	SM, SM-SC, SP-SM	A-2, A-3, A-4, A-1	0	90-100	80-100	40-85	5-45	<25	NP-7
	26-60	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	95-100	90-100	80-95	55-90	20-38	8-25
17A Wixom	0-9	Loamy sand	SM	A-2-4	0	95-100	95-100	50-70	15-30	---	NP
	9-26	Loamy sand, sand, loamy fine sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<20	NP-4
	26-60	Silty clay loam, sandy clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	51-95	20-40	5-25
23 Tappan	0-10	Loam	CL, ML, CL-ML	A-4, A-6	0-5	90-100	90-95	65-95	50-80	20-35	3-15
	10-29	Loam, clay loam	CL	A-6	0-5	90-100	90-95	85-95	55-80	20-40	10-25
	29-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	90-100	90-95	85-95	55-75	20-35	5-15
25A Pipestone	0-9	Fine sand	SP-SM, SM	A-1, A-2-4, A-3	0	95-100	90-100	40-75	5-30	---	NP
	9-55	Sand, fine sand, loamy fine sand.	SP, SP-SM, SM	A-1, A-2-4, A-3	0	95-100	90-100	40-75	2-30	---	NP
	55-60	Clay loam, loam	CL, ML, CL-ML	A-4, A-6	0-5	90-100	90-100	75-100	50-90	25-40	3-15
31 Sloan	0-11	Loam	CL, ML, CL-ML	A-6, A-4	0	100	95-100	85-100	70-95	20-40	3-15
	11-60	Silty clay loam, clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	75-95	30-45	8-18
35A Pipestone	0-8	Fine sand	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	8-30	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	30-60	Sand, fine sand	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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----------------- Rousseau	0-6	Fine sand-------	SP-SM, SM	A-2-4, A-3	0	100	100	90-100	5-35	---	NP
	6-23	Fine sand-------	SP-SM, SM	A-3, A-2-4	0	100	100	90-100	5-25	---	NP
	23-60	Fine sand, sand	SP, SP-SM	A-3	0	100	100	85-100	0-10	---	NP
43A----------------- Londo	0-7	Loam------------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	7-20	Clay loam-------	CL	A-6	0	95-100	90-100	85-95	65-80	25-40	11-25
	20-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	25-35	5-15
49A*:											
Londo-------------	0-7	Loam------------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	7-20	Clay loam-------	CL	A-6	0	95-100	90-100	85-95	65-80	25-40	11-25
	20-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	25-35	5-15
Poseyville---------	0-13	Loamy sand, sand	SM	A-2-4, A-1	0-2	95-100	90-100	45-75	15-30	---	NP
	13-22	Sandy loam, very fine sand, silt loam.	SM, SM-SC	A-2-4, A-4	0-2	95-100	90-100	55-85	25-50	<25	NP-5
	22-60	Loam, clay loam	CL	A-4, A-6	0-2	95-100	90-100	80-100	60-80	25-36	8-18
50----------------- Cohoctah	0-11	Loamy fine sand	SM	A-2	0	100	100	50-75	15-30	<20	NP-4
	11-18	Loam, fine sandy loam, sandy loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	70-90	30-70	<30	NP-10
	18-60	Loam, fine sandy loam, loamy fine sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
51. Urban land											
52*: Urban land.											
Tappan------------	0-10	Loam------------	CL, ML, CL-ML	A-4, A-6	0-5	90-100	90-95	65-95	50-80	20-35	3-15
	10-29	Loam, clay loam	CL	A-6	0-5	90-100	90-95	85-95	55-80	20-40	10-25
	29-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	90-100	90-95	85-95	55-75	20-35	5-15
53A*: Urban land.											
Londo-------------	0-7	Loam------------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	7-20	Clay loam-------	CL	A-6	0	95-100	90-100	85-95	65-80	25-40	11-25
	20-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	25-35	5-15
54B*: Urban land.											
Rousseau----------	0-6	Fine sand-------	SP-SM, SM	A-2-4, A-3	0	100	100	90-100	5-35	---	NP
	6-23	Fine sand-------	SP-SM, SM	A-3, A-2-4	0	100	100	90-100	5-25	---	NP
	23-60	Fine sand, sand	SP, SP-SM	A-3	0	100	100	85-100	0-10	---	NP
55. Aquents											
56. Dumps											

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
57A----------------- Poseyville	0-13	Loamy sand------	SM	A-2-4, A-1	0-2	95-100	90-100	45-75	15-30	---	NP
	13-22	Sandy loam, very fine, sandy loam.	SM, SM-SC	A-2-4, A-4	0-2	95-100	90-100	55-85	25-50	<25	NP-5
	22-60	Loam, clay loam	CL	A-4, A-6	0-2	95-100	90-100	80-100	60-80	25-36	8-18
58A*:											
Tappan------------	0-10	Loam------------	CL, ML, CL-ML	A-4, A-6	0-5	90-100	90-95	65-95	50-80	20-35	3-15
	10-29	Loam, clay loam	CL	A-6	0-5	90-100	90-95	85-95	55-80	20-40	10-25
	29-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	90-100	90-95	85-95	55-75	20-35	5-15
Poseyville--------	0-13	Loamy sand, sand	SM	A-2-4, A-1	0-2	95-100	90-100	45-75	15-30	---	NP
	13-22	Sandy loam, very fine sand, silt loam.	SM, SM-SC	A-2-4, A-4	0-2	95-100	90-100	55-85	25-50	<25	NP-5
	22-60	Loam, clay loam	CL	A-4, A-6	0-2	95-100	90-100	80-100	60-80	25-36	8-18
59----------------- Tobico	0-8	Fine sand-------	SP-SM, SM	A-3, A-2	0	100	90-100	50-80	5-30	---	NP
	8-60	Sand, fine sand	SP-SM, SP, SM	A-1, A-2, A-3	0	75-100	70-100	35-75	0-30	---	NP
60*: Urban land.											
Essexville--------	0-11	Loamy sand------	SM, SM-SC	A-2, A-4	0	100	95-100	50-85	15-45	<20	NP-7
	11-26	Loamy fine sand, fine sand, sand.	SM, SM-SC, SP-SM	A-2, A-3, A-4, A-1	0	90-100	80-100	40-85	5-45	<25	NP-7
	26-60	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	95-100	90-100	80-95	55-90	20-38	8-25
61----------------- Cohoctah	0-11	Fine sandy loam	ML, SM	A-4, A-2	0	100	100	65-95	30-75	<30	NP-6
	11-18	Loam, fine sandy loam, sandy loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	70-90	30-70	<30	NP-10
	18-60	Loam, fine sandy loam, loamy fine sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
62A*:											
Sanilac-----------	0-10	Very fine sandy loam.	SM, ML	A-4	0	100	100	85-95	40-65	<20	NP-4
	10-42	Loamy very fine sand, silt loam, very fine sand.	ML, SM	A-4	0	100	100	75-95	35-60	<25	NP-4
	42-60	Stratified loamy very fine sand to silt loam.	SM, SC, ML, CL	A-4	0	100	80-100	75-95	35-60	15-30	NP-10
Bach--------------	0-13	Very fine sandy loam.	ML, SM	A-4	0	100	100	85-95	40-65	<15	NP-4
	13-60	Loam, silt loam, very fine sand.	ML, SM	A-2-4, A-4	0	100	80-100	70-95	25-95	<35	NP-4
63A*:											
Rapson------------	0-29	Loamy fine sand, fine sand.	SP-SM, SM	A-2-4, A-3	0	95-100	95-100	50-75	5-25	---	NP
	29-60	Stratified very fine sand to silty clay loam	ML, CL, CL-ML	A-4	0	100	100	75-90	50-70	<25	NP-10

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
63A*:											
Bach----------------	0-13	Very fine sandy loam.	ML, SM	A-4	0	100	100	85-95	40-65	<15	NP-4
	13-60	Loam, silt loam, very fine sand.	ML, SM	A-2-4, A-4	0	100	80-100	70-95	25-95	<35	NP-4
64B*:											
Londo--------------	0-7	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	95-100	90-100	75-95	40-55	<25	NP-5
	7-20	Clay loam--------	CL	A-6	0	95-100	90-100	85-95	65-80	25-40	11-25
	20-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	25-35	5-15
Wixom--------------	0-9	Loamy sand-------	SM	A-2-4	0	95-100	95-100	50-70	15-30	---	NP
	9-26	Loamy sand, sand, loamy fine sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<20	NP-4
	26-60	Silty clay loam, sandy clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	51-95	20-40	5-25
65B*:											
Guelph-------------	0-8	Sandy loam-------	ML, SM, SC, CL	A-4, A-2-4, A-6	0-5	95-100	90-95	55-90	25-70	20-35	2-12
	8-22	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-90	70-85	25-40	5-20
	22-60	Loam, clay loam	CL-ML, CL	A-6, A-4	0-5	95-100	85-95	75-95	55-75	20-30	4-14
Menominee----------	0-11	Loamy sand-------	SM, SP-SM	A-2-4	0	95-100	95-100	50-75	15-30	---	NP
	11-33	Sand, loamy fine sand.	SP, SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	0-15	---	NP
	33-60	Clay loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-10	85-95	85-95	80-95	60-90	25-40	5-20
66A*:											
Pipestone----------	0-8	Fine sand--------	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	8-30	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	30-60	Sand, fine sand	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP
Tobico-------------	0-8	Fine sand--------	SP-SM, SM	A-3, A-2	0	100	90-100	50-80	5-30	---	NP
	8-60	Sand, fine sand	SP-SM, SP, SM	A-1, A-2, A-3	0	75-100	70-100	35-75	0-30	---	NP
67----------------- Belleville	0-11	Loamy sand-------	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
	11-36	Sand, loamy sand, loamy fine sand.	SM	A-2	0	100	95-100	50-85	15-30	<20	NP-4
	36-60	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0	100	90-100	90-100	70-90	25-50	11-23

* This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF 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 <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
12*:											
Corunna----------	0-10	5-15	1.61-1.73	0.6-6.0	0.14-0.22	6.1-7.8	Low-----------	0.20	4	3	1-2
	10-29	10-18	1.29-1.83	0.6-6.0	0.08-0.14	6.1-7.8	Low-----------	0.20			
	29-60	14-28	1.46-1.95	0.2-0.6	0.16-0.20	7.4-8.4	Moderate-----	0.43			
Tappan-----------	0-10	12-20	1.12-1.59	2.0-6.0	0.12-0.15	7.4-8.4	Low-----------	0.20	4L	3	1-4
	10-29	18-30	1.48-1.80	0.2-2.0	0.14-0.19	7.9-8.4	Low-----------	0.28			
	29-60	15-28	1.46-1.95	0.06-0.2	0.15-0.19	7.9-8.4	Low-----------	0.28			
13--------------- Belleville	0-11	3-12	0.92-1.59	6.0-20	0.10-0.12	6.1-7.8	Low-----------	0.17	5	2	.5-3
	11-36	2-12	1.45-1.73	6.0-20	0.06-0.10	6.1-8.4	Low-----------	0.17			
	36-60	27-35	1.46-1.95	0.2-0.6	0.14-0.20	7.4-8.4	Moderate-----	0.32			
16--------------- Essexville	0-11	3-12	0.92-1.59	6.0-20	0.10-0.14	7.4-8.4	Low-----------	0.17	5	2	.5-3
	11-26	2-12	1.45-1.73	6.0-20	0.04-0.12	7.9-8.4	Low-----------	0.17			
	26-60	15-35	1.46-1.95	0.2-0.6	0.12-0.20	7.9-8.4	Moderate-----	0.32			
17A-------------- Wixom	0-9	2-12	0.92-1.59	6.0-20	0.10-0.12	5.1-7.3	Low-----------	0.15	3	2	2-4
	9-26	2-14	1.43-1.73	6.0-20	0.06-0.11	5.1-7.3	Low-----------	0.15			
	26-60	18-35	1.33-1.89	0.2-0.6	0.14-0.20	6.1-7.8	Moderate-----	0.43			
23--------------- Tappan	0-10	15-25	1.12-1.59	0.6-2.0	0.18-0.22	7.4-8.4	Low-----------	0.28	5	5	1-4
	10-29	18-30	1.48-1.80	0.2-2.0	0.14-0.19	7.9-8.4	Low-----------	0.28			
	29-60	15-28	1.46-1.95	0.06-0.2	0.15-0.19	7.9-8.4	Low-----------	0.28			
25A-------------- Pipestone	0-9	2-12	0.63-1.57	6.0-20	0.06-0.10	4.5-7.3	Low-----------	0.17	5	1	3-4
	9-55	2-12	1.22-1.57	6.0-20	0.04-0.08	4.5-7.3	Low-----------	0.17			
	55-60	12-35	1.44-1.81	0.06-0.6	0.16-0.18	7.4-8.4	Moderate-----	0.32			
31--------------- Sloan	0-11	12-25	1.12-1.59	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.37	5	6	---
	11-60	18-35	1.48-1.95	0.2-2.0	0.15-0.19	6.1-8.4	Moderate-----	0.37			
35A-------------- Pipestone	0-8	2-12	0.63-1.57	6.0-20	0.07-0.10	4.5-7.3	Low-----------	0.17	5	1	3-4
	8-30	2-12	1.22-1.57	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.17			
	30-60	2-12	1.22-1.57	>20	0.05-0.07	5.1-7.3	Low-----------	0.17			
37B-------------- Rousseau	0-6	0-10	1.27-1.56	6.0-20	0.07-0.09	5.1-6.0	Low-----------	0.15	5	1	1-2
	6-23	0-10	1.26-1.60	6.0-20	0.06-0.08	4.5-6.0	Low-----------	0.15			
	23-60	0-10	1.48-1.67	6.0-20	0.05-0.07	5.6-6.5	Low-----------	0.15			
43A-------------- Londo	0-11	10-18	1.43-1.73	0.6-2.0	0.18-0.24	6.1-7.8	Low-----------	0.32	5	6	1-3
	11-21	27-35	1.44-1.81	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	21-60	20-32	1.47-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
49A*:											
Londo------------	0-11	10-18	1.43-1.73	0.6-2.0	0.18-0.24	6.1-7.8	Low-----------	0.32	5	6	1-3
	11-21	27-35	1.44-1.81	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	21-60	20-32	1.47-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
Poseyville-------	0-13	2-12	0.63-1.57	6.0-20	0.09-0.12	6.1-7.3	Low-----------	0.17	5	2	1-3
	13-22	12-18	1.22-1.57	6.0-20	0.06-0.14	6.6-7.8	Low-----------	0.17			
	22-60	18-35	1.47-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.37			
50--------------- Cohoctah	0-11	0-15	1.12-1.59	6.0-20	0.10-0.15	6.1-7.8	Low-----------	0.17	5	2	1-4
	11-18	5-27	1.48-1.80	2.0-6.0	0.12-0.20	6.1-8.4	Low-----------	0.28			
	18-60	2-25	1.46-1.95	2.0-6.0	0.08-0.20	6.1-8.4	Low-----------	0.28			
51. Urban land											
52*: Urban land.											

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	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/cm^3	In/hr	In/in	pH					Pct
52*:											
Tappan----------	0-10	15-25	1.12-1.59	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.28	5	5	1-4
	10-29	18-30	1.48-1.80	0.2-2.0	0.14-0.19	7.9-8.4	Low----------	0.28			
	29-60	15-28	1.46-1.95	0.06-0.2	0.15-0.19	7.9-8.4	Low----------	0.28			
53A*:											
Urban land.											
Londo-----------	0-7	10-18	1.43-1.73	0.6-2.0	0.18-0.24	6.1-7.8	Low----------	0.32	5	6	1-3
	7-20	27-35	1.44-1.81	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	20-60	20-32	1.47-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
54B*:											
Urban land.											
Rousseau--------	0-6	0-10	1.27-1.56	6.0-20	0.07-0.09	5.1-6.0	Low----------	0.15	5	1	1-2
	6-23	0-10	1.26-1.60	6.0-20	0.06-0.08	4.5-6.0	Low----------	0.15			
	23-60	0-10	1.48-1.67	6.0-20	0.05-0.07	5.6-6.5	Low----------	0.15			
55. Aquents											
56. Dumps											
57A-------------- Poseyville	0-13	2-12	0.63-1.57	6.0-20	0.09-0.12	6.1-7.3	Low----------	0.17	5	2	1-3
	13-22	12-18	1.22-1.57	6.0-20	0.06-0.14	6.6-7.8	Low----------	0.17			
	22-60	18-35	1.47-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.37			
58A*:											
Tappan----------	0-10	15-25	1.12-1.59	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.28	5	5	1-4
	10-29	18-30	1.48-1.80	0.2-2.0	0.14-0.19	7.9-8.4	Low----------	0.28			
	29-60	15-28	1.46-1.95	0.06-0.2	0.15-0.19	7.9-8.4	Low----------	0.28			
Poseyville------	0-13	2-12	0.63-1.57	6.0-20	0.09-0.12	6.1-7.3	Low----------	0.17	5	2	1-3
	13-22	12-18	1.22-1.57	6.0-20	0.06-0.14	6.6-7.8	Low----------	0.17			
	22-60	18-35	1.47-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.37			
59-------------- Tobico	0-8	2-10	0.92-1.59	6.0-20	0.06-0.11	6.1-7.8	Low----------	0.15	5	1	4-6
	8-60	0-10	1.45-1.74	>20	0.04-0.07	7.4-8.4	Low----------	0.15			
60*:											
Urban land.											
Essexville------	0-11	3-12	0.92-1.59	6.0-20	0.10-0.14	7.4-8.4	Low----------	0.17	4	2	.5-3
	11-26	2-12	1.45-1.73	6.0-20	0.04-0.12	7.9-8.4	Low----------	0.17			
	26-60	15-35	1.46-1.95	0.2-0.6	0.12-0.20	7.9-8.4	Moderate-----	0.32			
61-------------- Cohoctah	0-11	5-20	1.12-1.59	2.0-6.0	0.13-0.22	6.1-7.8	Low----------	0.28	5	3	1-4
	11-18	5-27	1.48-1.80	2.0-6.0	0.12-0.20	6.1-8.4	Low----------	0.28			
	18-60	2-25	1.46-1.95	2.0-6.0	0.08-0.20	6.1-8.4	Low----------	0.28			
62A*:											
Sanilac---------	0-10	3-15	1.43-1.73	2.0-6.0	0.15-0.22	6.6-8.4	Low----------	0.37	5	3	1-3
	10-42	0-18	1.44-1.81	0.2-2.0	0.06-0.22	7.9-8.4	Low----------	0.37			
	42-60	0-18	1.47-1.90	0.2-2.0	0.06-0.22	7.9-8.4	Low----------	0.37			
Bach------------	0-13	2-15	1.12-1.59	2.0-6.0	0.20-0.22	6.6-8.4	Low----------	0.28	5	3	1-4
	13-60	0-18	1.48-1.95	0.6-2.0	0.14-0.22	7.9-8.4	Low----------	0.28			
63A*:											
Rapson----------	0-29	2-15	1.29-1.72	6.0-20	0.06-0.12	5.6-7.8	Low----------	0.17	5	2	2-3
	29-60	10-35	1.40-1.94	0.6-2.0	0.05-0.20	7.9-8.4	Low----------	0.43			
Bach------------	0-13	2-15	1.12-1.59	2.0-6.0	0.20-0.22	6.6-8.4	Low----------	0.28	5	3	1-4
	13-60	0-18	1.48-1.95	0.6-2.0	0.14-0.22	7.9-8.4	Low----------	0.28			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
64B*:											
Londo-----------	0-7	5-18	1.43-1.73	2.0-6.0	0.14-0.18	6.1-7.8	Low-----------	0.32	5	3	1-3
	7-20	27-35	1.44-1.81	0.2-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	20-60	20-32	1.47-1.90	0.2-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32			
Wixom-----------	0-9	2-12	0.92-1.59	6.0-20	0.10-0.12	5.1-7.3	Low-----------	0.15	3	2	2-4
	9-26	2-14	1.43-1.73	6.0-20	0.06-0.11	5.1-7.3	Low-----------	0.15			
	26-60	18-35	1.33-1.89	0.2-0.6	0.14-0.20	6.1-7.8	Moderate-----	0.43			
65B*:											
Guelph----------	0-8	12-25	1.31-1.78	0.6-2.0	0.14-0.20	6.1-7.8	Low-----------	0.32	5	5	1-3
	8-22	18-35	1.31-1.86	0.2-0.6	0.14-0.18	6.1-7.8	Low-----------	0.32			
	22-60	18-32	1.33-1.89	0.2-0.6	0.14-0.18	7.9-8.4	Low-----------	0.32			
Menominee-------	0-11	2-15	1.14-1.60	2.0-6.0	0.10-0.12	5.1-6.5	Low-----------	0.17	5	2	2-4
	11-33	5-15	1.26-1.59	6.0-20	0.04-0.10	5.1-6.5	Low-----------	0.17			
	33-60	18-35	1.33-1.89	0.2-0.6	0.14-0.18	5.6-7.8	Moderate-----	0.32			
66A*:											
Pipestone-------	0-8	2-12	0.63-1.57	6.0-20	0.07-0.10	4.5-7.3	Low-----------	0.17	5	1	3-4
	8-30	2-12	1.22-1.57	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.17			
	30-60	2-12	1.22-1.57	>20	0.05-0.07	5.1-7.3	Low-----------	0.17			
Tobico----------	0-8	2-10	0.92-1.59	6.0-20	0.06-0.11	6.1-7.8	Low-----------	0.15	5	1	4-6
	8-60	0-10	1.45-1.74	>20	0.04-0.07	7.4-8.4	Low-----------	0.15			
67--------------- Belleville	0-11	2-12	1.35-1.50	6.0-20	0.10-0.12	6.1-7.8	Low-----------	---	---	2	4-6
	11-36	2-15	1.40-1.55	6.0-20	0.06-0.10	6.1-7.8	Low-----------	---			
	36-60	18-35	1.46-1.95	0.2-0.6	0.14-0.20	7.4-8.4	Moderate-----	---			

* This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "brief," "apparent," and "perched." Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
12*:										
Corunna----------	B/D	Frequent----	Brief-----	Mar-May	0-1.0	Apparent	Nov-May	High-----	High-----	Low.
Tappan-----------	B/D	Frequent----	Brief-----	Jan-May	0-1.0	Apparent	Nov-May	High-----	High-----	Low.
13---------------- Belleville	A/D	Frequent----	Brief-----	Mar-Apr	0-1.0	Apparent	Mar-May	High-----	High-----	Low.
16---------------- Essexville	A/D	Occasional	Brief-----	Nov-Jun	0-1.0	Apparent	Nov-May	High-----	High-----	Low.
17A--------------- Wixom	B	None--------	---	---	1.0-2.0	Perched	Nov-Jun	Moderate	Moderate	High.
23---------------- Tappan	B/D	Frequent----	Brief-----	Jan-May	0-1.0	Apparent	Nov-May	High-----	High-----	Low.
25A--------------- Pipestone	C	None--------	---	---	0.5-1.5	Apparent	Nov-May	Moderate	Low------	Moderate.
31---------------- Sloan	B/D	Frequent----	Brief to long.	Nov-Jun	0-1.0	Apparent	Nov-Jun	High-----	High-----	Low.
35A--------------- Pipestone	A	None--------	---	---	0.5-1.5	Apparent	Oct-Jun	Moderate	Low------	Moderate.
37B--------------- Rousseau	A	None--------	---	---	2.5-6.0	Apparent	Mar-May	Low------	Low------	Moderate.
43A--------------- Londo	C	None--------	---	---	1.0-2.0	Apparent	Nov-May	High-----	High-----	Low.
49A*:										
Londo------------	C	None--------	---	---	1.0-2.0	Apparent	Nov-May	High-----	High-----	Low.
Poseyville-------	C	None--------	---	---	1.0-2.0	Apparent	Nov-May	High-----	High-----	Low.
50---------------- Cohoctah	B/D	Frequent----	Brief to long.	Jan-Dec	0-1.0	Apparent	Sep-May	High-----	High-----	Low.
51. Urban land										
52*: Urban land.										
Tappan-----------	B/D	Frequent----	Brief-----	Jan-May	0-1.0	Apparent	Nov-May	High-----	High-----	Low.
53A*: Urban land.										
Londo------------	C	None--------	---	---	1.0-2.0	Apparent	Nov-May	High-----	High-----	Low.
54B*: Urban land.										
Rousseau---------	A	None--------	---	---	2.5-6.0	Apparent	Mar-May	Low------	Low------	Moderate.
55. Aquents										
56. Dumps										

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
57A-----Poseyville	C	None-----	---	---	1.0-2.0	Apparent	Nov-May	High-----	High-----	Low.
58A*:										
Tappan-----	B/D	Frequent----	Brief-----	Jan-May	0-1.0	Apparent	Nov-May	High-----	High-----	Low.
Poseyville-----	C	None-----	---	---	1.0-2.0	Apparent	Nov-May	High-----	High-----	Low.
59-----Tobico	A/D	Frequent----	Brief-----	Sep-May	0-1.0	Apparent	Sep-Jun	Moderate	High-----	Low.
60*:										
Urban land.										
Essexville-----	A/D	Occasional	Brief-----	Nov-Jun	0-1.0	Apparent	Nov-May	High-----	High-----	Low.
61-----Cohoctah	B/D	Occasional	Brief to long.	Jan-Dec	0-1.0	Apparent	Oct-May	High-----	High-----	Low.
62A*:										
Sanilac-----	B	None-----	---	---	1.0-2.0	Apparent	Nov-May	High-----	Moderate	Low.
Bach-----	B/D	Frequent----	Brief-----	Oct-May	0-1.0	Apparent	Nov-May	High-----	High-----	Low.
63A*:										
Rapson-----	B	None-----	---	---	1.0-2.0	Apparent	Nov-May	Moderate	Low-----	High.
Bach-----	B/D	Frequent----	Brief-----	Oct-May	0-1.0	Apparent	Nov-May	High-----	High-----	Low.
64B*:										
Londo-----	C	None-----	---	---	1.0-2.0	Apparent	Nov-May	High-----	High-----	Low.
Wixom-----	B	None-----	---	---	1.0-2.0	Perched	Nov-May	Moderate	Moderate	High.
65B*:										
Guelph-----	B	None-----	---	---	2.5-6.0	Perched	Dec-Apr	Moderate	Moderate	Low.
Menominee-----	A	None-----	---	---	2.5-6.0	Perched	Dec-Apr	Low-----	Low-----	Moderate
66A*:										
Pipestone-----	A	None-----	---	---	0.5-1.5	Apparent	Oct-Jun	Moderate	Low-----	Moderate
Tobico-----	A/D	Frequent----	Brief-----	Sep-May	0-1.0	Apparent	Oct-Jun	Moderate	High-----	Low.
67**:										
Belleville-----	N/D	Frequent----	Very long	Sep-Jul	+2-0.5	Apparent	Sep-Jul	High-----	High-----	Low.

* This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

** In the "High water table--Depth" column, 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.

TABLE 18.--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
Aquents	Mixed (calcareous), mesic Aquents
*Bach	Coarse-silty, mixed (calcareous), mesic Mollic Haplaquepts
*Belleville	Sandy over loamy, mixed, mesic Typic Haplaquolls
*Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
*Corunna	Coarse-loamy, mixed, mesic Typic Haplaquolls
Essexville	Sandy over loamy, mixed (calcareous), mesic Typic Haplaquolls
Guelph	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
*Londo	Fine-loamy, mixed, mesic Aeric Glossaqualfs
*Menominee	Sandy over loamy, mixed, frigid Alfic Haplorthods
Pipestone	Sandy, mixed, mesic Entic Haplaquods
Poseyville	Coarse-loamy, mixed, mesic Psammaquentic Hapludalfs
Rapson	Sandy over loamy, mixed, mesic Entic Haplaquods
*Rousseau	Sandy, mixed, frigid Entic Haplorthods
Sanilac	Coarse-silty, mixed (calcareous), mesic Aeric Haplaquepts
*Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Tappan	Fine-loamy, mixed (calcareous), mesic Typic Haplaquolls
*Tobico	Mixed, mesic Mollic Psammaquents
Wixom	Sandy over loamy, mixed, mesic Alfic Haplaquods

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Nondiscrimination Statement

Nondiscrimination Policy

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the basis of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, whether all or part of an individual's income is derived from any public assistance program, or protected genetic information. The Department prohibits discrimination in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases apply to all programs and/or employment activities.)

To File an Employment Complaint

If you wish to file an employment complaint, you must contact your agency's EEO Counselor (http://directives.sc.egov.usda.gov/33081.wba) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to U.S. Department of Agriculture; Director, Office of Adjudication; 1400 Independence Avenue, S.W.; Washington, D.C. 20250-9419; by fax to (202) 690-7442; or by email to program.intake@usda.gov.

Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).