SOIL SURVEY OF

GRATIOT COUNTY, MICHIGAN

United States Department of Agriculture

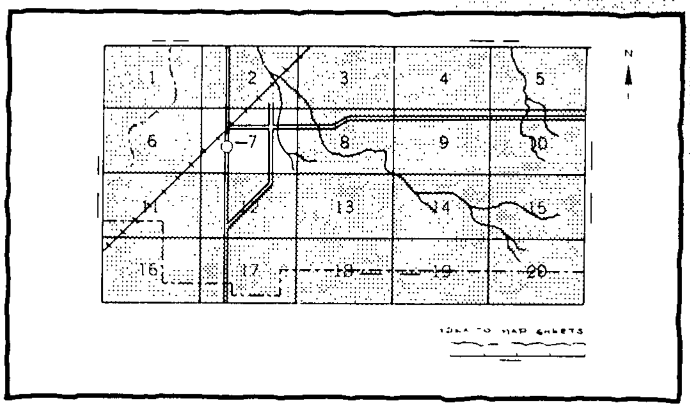
Soil Conservation Service

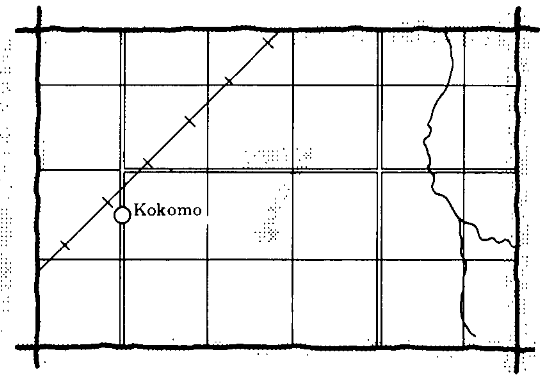
in cooperation with

Michigan Agricultural Experiment Station

HOW TO USE

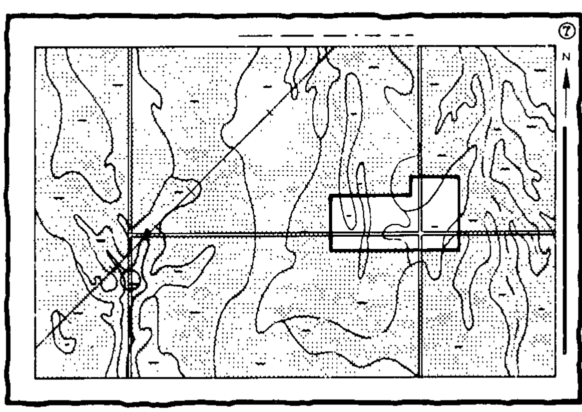
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

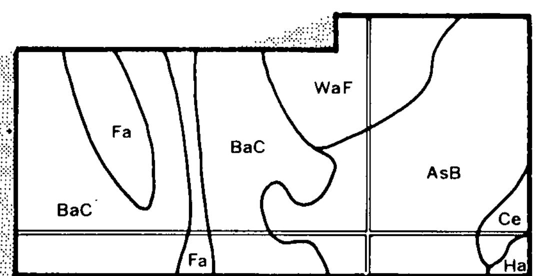




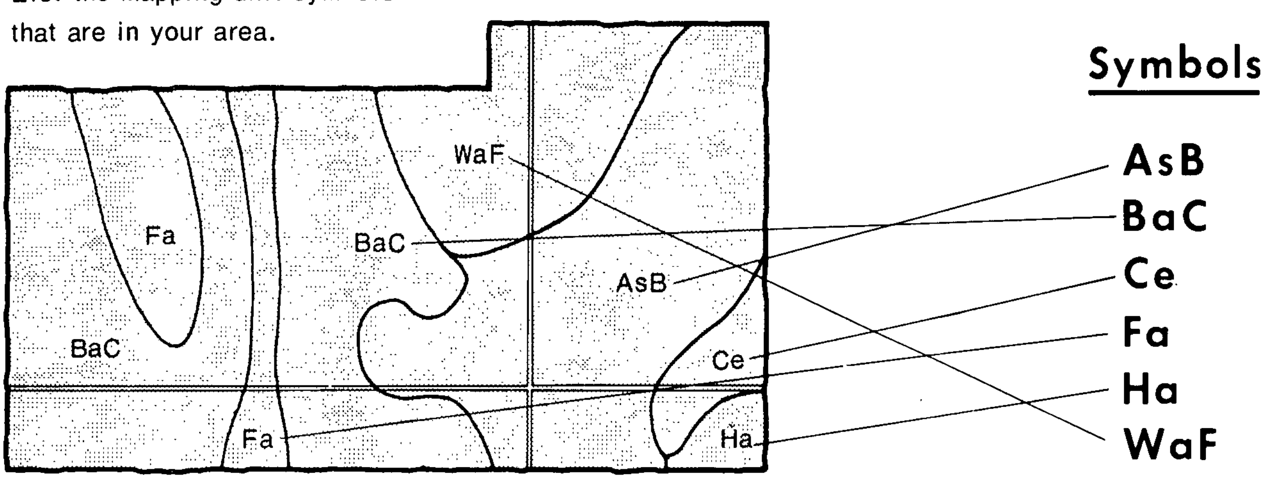
2. Note the number of the map sheet and turn to that sheet.

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



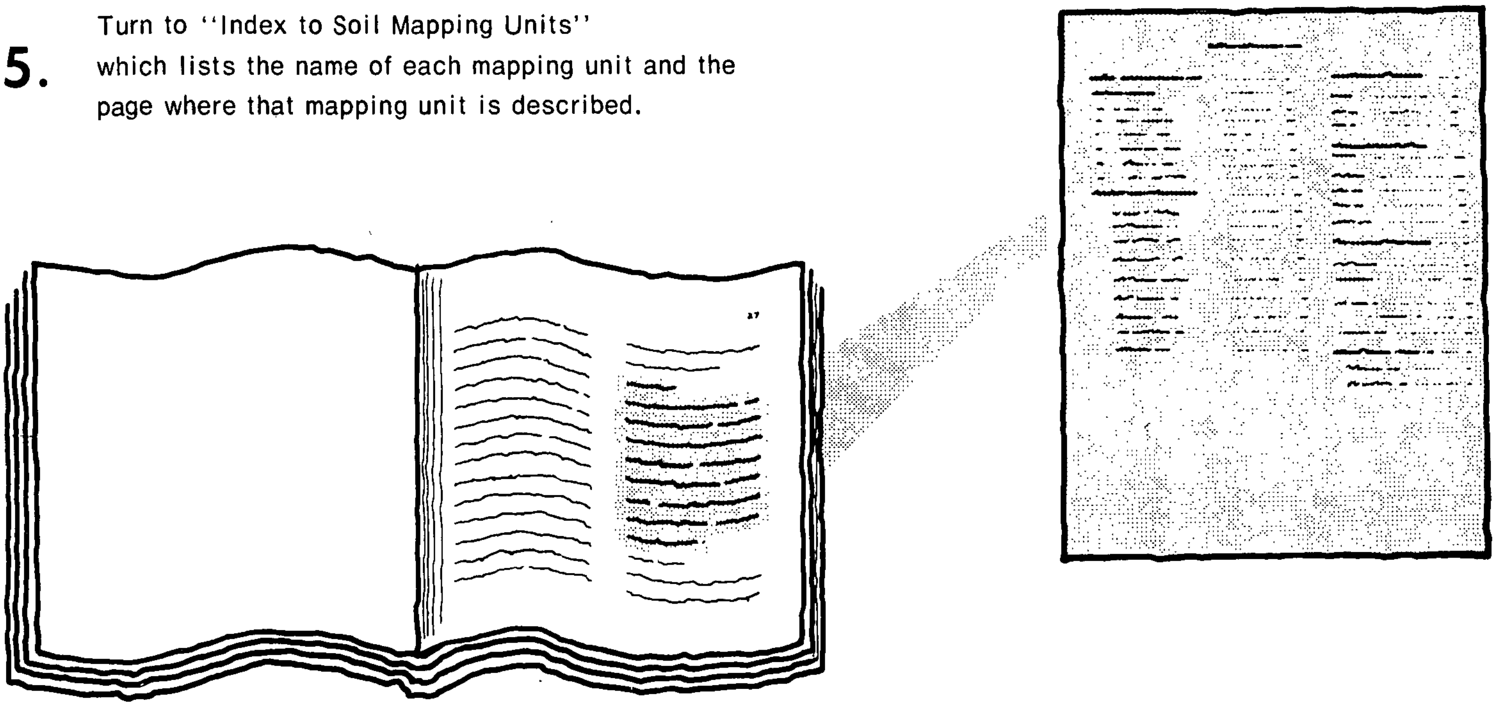


4. List the mapping unit symbols that are in your area.

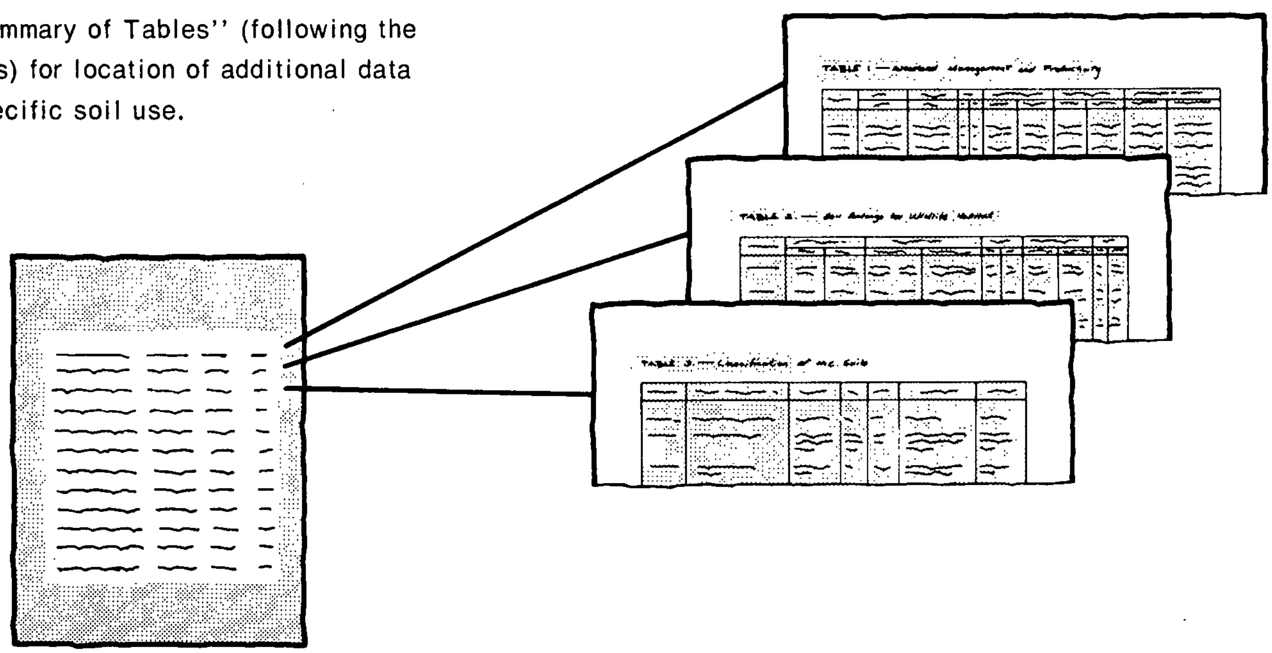


THIS SOIL SURVEY

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



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



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

This 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 completed in the period 1967 to 1975. Soil names and descriptions were approved in December 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. 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 Gratiot County Soil Conservation District. It was partly financed by the Gratiot County Board of Commissioners.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can 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.

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Issued April 1979

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Foreword

The Soil Survey of Gratiot County, Michigan contains much information useful in any land-planning program. 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.

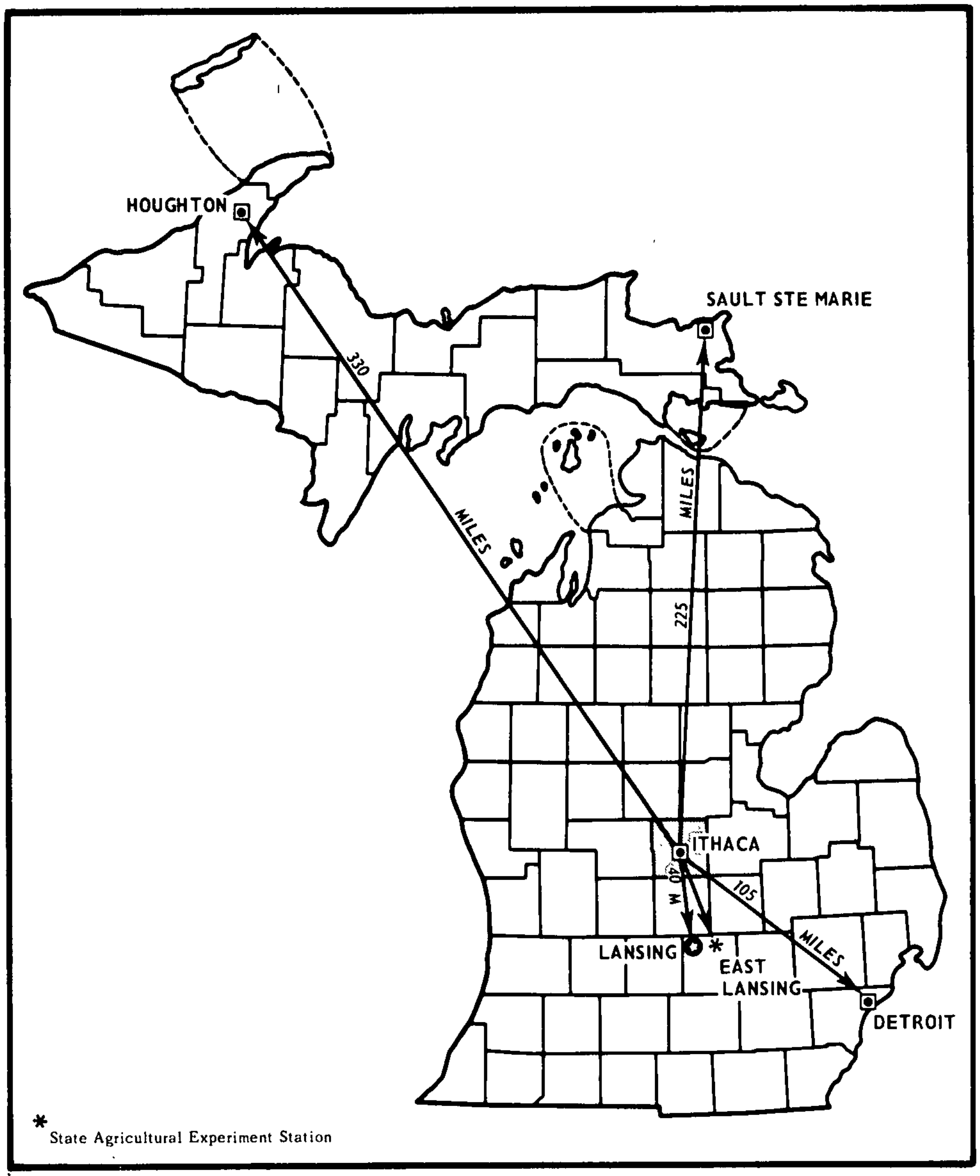
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers 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 shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to 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.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

A. H. Cratty
State Conservationist
Soil Conservation Service



Location of Gratiot County in Michigan.

SOIL SURVEY OF GRATIOT COUNTY, MICHIGAN

By James E. Feenstra, Soil Conservation Service

Fieldwork by James E. Feenstra, John Long, and Glenn A. Weesies, Soil Conservation Service; and David Krauss and Terence H. Cooper, Michigan Agricultural Experiment Station

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

GRATIOT COUNTY is the geographical center of the lower peninsula of the State of Michigan. Ithaca, the county seat, is near the center of the county. The area of the county is approximately 570 square miles, or 362,240 acres. Most of the county is well suited to agriculture and is among the leading counties in the state in agricultural production.

The population of Gratiot County in 1970 was 39,246. About 17.8 percent of the people live on farms. Some of these people work in factories. The remaining 82.2 percent work at various jobs in Gratiot County and in neighboring counties. Industries are principally oil refining and manufacturing chemicals, automotive parts, and mobile homes.

With 83.4 percent of the land in farms, agriculture is the principal enterprise. Corn, field beans, soybeans, and wheat are the main crops. Oats, barley, sugar beets, alfalfa, kidney beans, and cucumbers are also grown. Dairy cows, beef cattle, and other livestock are kept on some farms. In a few areas of organic soils, mainly west and south of Ithaca, potatoes, commercial sod, carrots, and other vegetables are grown.

About 8 percent of the survey area is woodland. The largest wooded areas are in the Gratiot-Saginaw State Game Area, the Maple River State Game Area, the Maple River and Pine River bottomlands, and the very northeastern and northwestern parts of the county. The principal woodland species in the wetlands are aspen, elm, cottonwood, swamp oak, soft maple, and ash. The Oakville, Plainfield, Marlette, and Boyer soils produce oak, maple, basswood, and pine plantations.

General nature of the county

This section gives general information concerning the county. It discusses climate, history and development, farming, industry and transportation, physiography, relief and drainage, and lakes and streams.

Climate

FRED V. NURNBERGER, meteorologist, Michigan Department of Agriculture, Weather Service, prepared this section.

Gratiot County is cold in winter and is warm and occasionally hot in summer. Precipitation is well distributed throughout the year but it peaks in summer. The amount of precipitation is adequate for most crops on most soils. Winter precipitation is mainly snow, and blizzards occur at times.

Table 1 shows temperature and precipitation data for the period 1945 to 1974. The data were recorded at Alma and are representative of the entire county. Table 2 shows probable dates of the first freeze in fall and the last in spring, and Table 3 shows the length of the growing season.

In winter, the average temperature is 24.4 degrees F and the average daily minimum is 16.4 degrees. The lowest recorded temperature is -29 degrees; it occurred at Alma on February 5, 1918. In summer, the average temperature is 69.7 degrees F and the average daily maximum is 81.8 degrees. The highest recorded temperature is 108 degrees; it occurred on July 14, 1936.

Growing degree days, shown in table 1, are equivalent to "heat units." Starting in spring, they accumulate by the amount that the average daily temperature exceeds a base temperature of 50 degrees F. The normal monthly accumulation is used to schedule single or successive plantings of a crop during the period between the last freeze in spring and the first in fall.

As shown in table 1, the total annual precipitation is 29.7 inches. Of this total, 18.3 inches, or 62 percent, generally falls during the period April through September, which includes the growing season for most crops. In 2 years in 10, however, rainfall during this period is less than 15.5 inches. The heaviest 1-day rainfall was 5.5 inches at Alma on September 7, 1894. Thunderstorms occur on about 34 days each year and on about 7 days in June.

Average seasonal snowfall is 41.3 inches. The greatest depth of the snow cover at any time during the period of record was 20 inches. On the average, there is at least 1 inch of snow on the ground on 68 days, but the number of days varies greatly from year to year.

According to data recorded at Lansing Capital City Airport and at Flint Bishop Airport, the average relative humidity in midafternoon is less than 58 percent in spring and about 64 percent during the rest of the year. Humidity is higher at night in all seasons, and at dawn it averages 82 percent. The percentage of possible sunshine is 68 in summer and 36 in winter. The prevailing wind is from the southwest. Average annual windspeed is 10.4 miles per hour. Windspeed is highest, 12.3 miles per hour on the average in January.

Severe thunderstorms occur occasionally, and tornadoes are rare. Both are generally local, are of short duration, and cause varying degrees of damage.

History and development

Gratiot County was created by an act of the State Legislature on February 3, 1855. It was named after General Charles Gratiot. At the time the county was created, seven townships were organized. Shortly thereafter, several other townships, formerly attached to Clinton and Saginaw counties were added to Gratiot County.

In 1832, William McOmber set up the Northwestern Fur Company and carried on considerable trade with the Chippewa Indians of Gratiot County.

Gratiot County was covered with pine, maple, beech, oak, ash, basswood, and elm with some butternut, hickory, and hemlock. Some of the swamps supported white cedar and tamarack forests. In 1855, the first saw mill was built on the Pine River at the present location of St. Louis. The early inhabitants came mostly from New York State, although many came from other eastern states and Canada. The first settlements were on the ridges and knolls, because at that time, the rest of the county was wet and swampy.

Travel during the time of settlement was very difficult. The only road through the county was known as the "Old Indian Trail" which extended from Maple Rapids to Lutheran Mission above St. Louis. Saginaw and Maple Rapids were the chief trading points of the area. The Pine River furnished transportation for supplies and lumber.

During early settlement, this county was known as "Starving Gratiot" and many settlers became discouraged. The area soon proved to be one of the best agricultural counties in the State. During the summer and fall of 1855 and the spring of 1856, the population rapidly increased, and large fields were cleared. Timber, however, was of little value until the advent of railroads.

The Saginaw Valley and St. Louis Railroad was first built from Saginaw to St. Louis. Later, it extended to Grand Rapids, and the name changed to Pere Marquette and then to C&O Railroad. The Toledo, Ann Arbor, and North Michigan Railroad was built about 1883 and is now known as the Ann Arbor Railroad. These railroads acted as a great stimulus in advancing the industries of the county.

Today, Gratiot County is first in the nation in the production of beans. It has some fine dairy farming, although the number of farms has declined in recent years.

In addition to agriculture, Gratiot County has many prosperous industries and some gas, brine, and oil wells.

Farming

Early in Gratiot County's history, it was difficult to raise crops because much of the area was wet swampland. Many of the early settlers then settled the higher and drier places, many of which were very sandy and unproductive, and others became discouraged with their venture and left.

Some of the settlers remained, however, and drained the wet land. Today, this land is one of the best agricultural areas in Michigan. In 1969, it had the highest percentage, 83.4, of land in farms. Cash crop farming is the most prevalent agricultural enterprise in Gratiot County. Most of the acreage for this type of farming is used for corn, dry beans, soybeans, and wheat. There are quite a few fine beef and dairy farms in the county. The number of dairy farms has decreased, while the number of cattle feeding operations has increased slightly in recent years.

Farmers in Gratiot County were concerned about water erosion, soil blowing, and removal of excess water. They organized the Gratiot Soil Conservation District on April 28, 1952.

About 301,873 acres was in farms in 1969. Of this total, 191,626 acres was in cropland and 10,954 acres of this cropland was used for pasture. In 1969, dry beans were the main row crop and 78,000 acres was harvested. Corn was harvested from 39,570 acres for grain and 6,363 acres for silage. Soybeans were harvested from 21,524 acres and wheat, from 15,529 acres.

Industry and transportation

Manufacturing is an important industry in Gratiot County. Almost three-quarters of the employment is in manufacturing. Industries include metal, plastic, dairy, chemical, petroleum, and paper products; building materials; and electricity.

Transportation is by air, railroad, and highways. There is one airport in the northwestern part of the county and one southwest of Alma.

There are 3 railroads in the county. The Ann Arbor Railroad extends northwest through the county from Ann Arbor and Toledo to Frankfort. The Chesapeake and Ohio Railroad extends east-west and runs through Alma and St. Louis. It connects Gratiot County with Saginaw and Port Huron to the east and Grand Rapids to the west. The Grand Trunk Railroad crosses the southern part of the county from east to west. It extends from Muskegon on the west to Ashley on the east where it connects with the Ann Arbor Railroad.

Three major regional state and federal highways serve Gratiot County. U.S. Highway 27 is a four-lane divided highway extending from I-94 on the south, through Lansing to I-75 on the north. A major east-west regional highway, M-46, is in the northern part of Gratiot County. It is a two-lane state highway connecting Gratiot County with the Thumb Area to the east and Muskegon to the west. A major east-west regional highway, M-57, is in the southern part of Gratiot County. It is a two-lane state highway connecting Gratiot County with I-75 and the Thumb Area to the east and Greenville and Grand Rapids to the west.

Physiography, relief, and drainage

Gratiot County is in the center of the lower peninsula of Michigan. It was completely covered by giant ice sheets during the Pleistocene Epoch. The series of glaciers in this period left deposits 50 to 500 feet thick on the original bedrock of limestone and sandstone. The present topography and soil material resulted mainly from the glacial deposits and lake formations of the Wisconsin Glacier, which was the last glacier to cover this area and which melted 10,000 to 12,000 years ago (*3*).

As the result of glaciation, two general physiographic areas are in the county. The western half of the county consists of a series of glacial moraines, till and outwash plains, and channels. These were formed directly by glacial action and deposition. The eastern half of the county is a level lake plain that was formed by and at one time covered by the waters of Lake Saginaw, a glacial lake.

Extending generally in a north-south direction through the center of Gratiot County is a range of rolling hills known as the Owosso Moraine. The moraine is 3 to 5 miles wide and 50 to 100 feet high. The most common soils on the moraine are Perrinton and Ithaca soils. Extending in the same general direction and just inside the western boundary of the Gratiot County line is the West Branch Moraine. This moraine is 1/2 mile to 4 miles wide and about the same height as the Owosso Moraine. The most common soils on this moraine are Marlette and Capac soils.

The rest of the western half of the county consists mainly of nearly level till plains and sandy outwash plains and channels. Capac and Parkhill soils are common on the till plains. These soils are well suited to agricultural use. Plainfield, Riverdale, and Vestaburg soils are on the sandy outwash plains and channels.

The soils on the lake plain in the eastern half of Gratiot County are well suited to agriculture. Parkhill, Lenawee, Selfridge, Dixboro, and Corunna soils are major soils in this area.

The water that once covered the lake plain drained through the old Grand River channel, which is near Maple Rapids. This channel is now the Maple River. As the water cut the channel deeper, it formed a sequence of smaller lakes in the bed of the original Lake Saginaw. The shorelines of these lakes are marked by beach ridges consisting of sand and gravel. One, the Arkona Beach Ridge, rises 5 to 15 feet above the landscape and is 50 to 300 feet wide, but it is discontinuous. The ridge extends northeast from one-half mile southeast of Pompei across U.S. Highway 27 to southeast of North Star. Here, it swings north just beyond Breckenridge and then to the west, where it becomes quite prominent. This ridge marks the western shoreline of Lake Arkona, an old glacial lake. South County Line Road, in the southeast corner of the county, is on the beach ridge that marks the eastern shoreline of Lake Arkona. Boyer and Spinks soils are the major soils.

A smaller and lower lake plain is old Lake Warren. Ridges of its shoreline are exposed 2 miles east of Ashley and in the northeast corner of the county on broad, sandy flats. Oakville, Kingsville, and Arkona soils are on the flats. A low, gravelly ridge of this shoreline is just northwest of Wheeler.

Another feature on the lake plain is a swamp about 1 mile southeast of Ashley. This swamp is about 1/4 mile wide and about 3 miles long. It extends in a northeast-southwest direction. It is the result of erosion at the head of the old Grand River channel. Material deposited by the Maple River blocked off part of the channel, and muck formed in the channel bed.

Lakes and streams

Gratiot County has two natural lakes, Half Moon and Madison. They are small and privately owned and are in Seville Township.

Rainbow Lake, a man-made reservoir on Pine Creek, is in Fulton Township. It is also privately owned and is developing into a residential community.

There are two man-made reservoirs on the Pine River; one in the city of Alma and one in St. Louis.

There are two major streams in the county: the Pine River, in the northern part of the county, which flows northeasterly, and the Maple River, in the southern part, which flows westerly.

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 a guide for classifying and naming the soils was worked out, 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 soil 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 discussed in the sections "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 rangeland and 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 map units

Nearly level, somewhat poorly drained to very poorly drained clay loams, loams, and sandy loams

1. Lenawee-Toledo-Pert

Nearly level, very poorly drained to somewhat poorly drained soils that have a clayey or loamy subsoil; formed in lacustrine sediment

This map unit consists of nearly level soils on old glacial lakebeds. It occupies about 7 percent of the county. It is about 51 percent Lenawee and similar soils, 30 percent Toledo and similar soils, and 13 percent Pert and similar soils. Soils of minor extent make up the rest.

Lenawee soils are nearly level and are very poorly drained and poorly drained. The surface layer is very dark grayish brown clay loam about 9 inches thick. The subsoil is about 28 inches thick. The upper part of the subsoil is dark gray, mottled, firm clay loam, and the lower part is gray, mottled, very firm clay loam. The substratum, to a depth of 60 inches, is gray, mottled, calcareous clay loam and clay.

Toledo soils are nearly level and are very poorly drained. The surface layer is dark grayish brown clay loam about 9 inches thick. The subsoil is mottled and is about 39 inches thick. The upper part of the subsoil is dark gray, firm clay loam; the middle part is gray, firm silty clay; and the lower part is gray, very firm silty clay. The substratum, to a depth of 60 inches, is gray, calcareous silty clay.

Pert soils are nearly level and are somewhat poorly drained. They are mostly in slightly higher places than the Lenawee and Toledo soils. The surface layer is very dark grayish brown clay loam about 9 inches thick. The subsoil is brown, mottled, and very firm, and it is about 10 inches thick. The upper part of the subsoil is clay, and the lower part is clay loam. The substratum, to a depth of 60 inches, is grayish brown, mottled, calcareous clay loam.

The minor soils are poorly drained and very poorly drained Sickles soils, very poorly drained Wauseon soils, and somewhat poorly drained Arkona and Tedrow soils. The Sickles and Wauseon soils are on broad flats in a position similar to that of the Lenawee and Toledo soils.

The Arkona and Tedrow soils are on ridges and are slightly higher in elevation than the Lenawee and Toledo soils.

Most of the acreage is in cultivated crops. Some areas are used for pasture and woodland. Most areas have been cleared and drained, but some swampy areas remain undrained. Wetness is the main limitation to use of the soils for farming and for most nonfarm purposes. Maintaining good soil tilth is also a problem.

The soils, if adequately drained, have good to fair potential for cultivated crops. Wetness is such a severe limitation and so difficult to overcome that the potential for residential and most other engineering uses is poor. The potential for development of habitat for wetland wildlife is good.

2. Parkhill-Corunna

Nearly level, very poorly drained and poorly drained soils that have a loamy subsoil; formed in glacial till

This map unit consists of nearly level soils on till plains, modified by glacial lake waters. It occupies about 23 percent of the county. It is about 69 percent Parkhill and similar soils and 12 percent Corunna and similar soils. Soils of minor extent make up the rest.

Parkhill soils are nearly level and are poorly drained and very poorly drained. The surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is mottled, firm clay loam, and it is about 27 inches thick. The upper part of the subsoil is grayish brown, and the lower part is gray. The substratum, to a depth of 60 inches, is gray and yellowish brown, mottled, calcareous loam.

Corunna soils are nearly level and are poorly drained and very poorly drained. The surface layer is very dark gray sandy loam about 9 inches thick. The subsoil is gray, mottled, friable sandy loam about 22 inches thick. The substratum, to a depth of 60 inches, is gray, mottled, calcareous loam and clay loam.

The minor soils are poorly drained and very poorly drained Belleville and Cohoctah soils; very poorly drained Sloan soils; and somewhat poorly drained Capac, Ceresco, Metamora, and Selfridge soils. The Belleville soils are on broad flats in a position similar to that of the Parkhill and Corunna soils. The Sloan, Ceresco, and Cohoctah soils are on the flood plains. The Capac, Metamora, and Selfridge soils are slightly higher in elevation than the Parkhill and Corunna soils.

Most of the acreage is in cultivated crops. Some areas are used for pasture and woodland. Most areas have been cleared and drained, but some swampy areas remain undrained. Wetness is the main limitation to use of the soils for farming and for most nonfarm purposes.

The soils, if adequately drained, have good potential for cultivated crops. Wetness is such a severe limitation and so difficult to overcome that the potential for residential and most other engineering uses is poor. The potential for development of habitat for wetland wildlife is good.

3. Capac-Parkhill-Metamora

Nearly level, very poorly drained to somewhat poorly drained soils that have a loamy subsoil; formed in glacial till

This map unit consists of nearly level soils on till plains. It occupies about 22 percent of the county. It is about 38 percent Capac and similar soils, 25 percent Parkhill and similar soils, and 9 percent Metamora and similar soils. Soils of minor extent make up the rest.

Capac soils are nearly level and are somewhat poorly drained. The surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is mottled, firm clay loam, and it is about 20 inches thick. The upper part of the subsoil is yellowish brown, the middle part is light yellowish brown, and the lower part is brown. The substratum, to a depth of 60 inches, is grayish brown, mottled, calcareous loam.

Parkhill soils are nearly level and are poorly drained and very poorly drained. In most places they are slightly lower in elevation than the Capac and Metamora soils. The surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is mottled, firm clay loam, and it is about 27 inches thick. The upper part of the subsoil is grayish brown, and the lower part is gray. The substratum, to a depth of 60 inches, is gray and yellowish brown, mottled, calcareous loam.

Metamora soils are nearly level and are somewhat poorly drained. The surface layer is very dark grayish brown sandy loam about 9 inches thick. The subsoil is grayish brown, mottled, and friable, and it is about 28 inches thick. The upper part of the subsoil is sandy loam, and the lower part is sandy clay loam. The substratum, to a depth of 60 inches, is brown, mottled, calcareous loam.

The minor soils are poorly drained and very poorly drained Corunna, Lenawee, Lamson, and Cohoctah soils; very poorly drained Sloan soils; and somewhat poorly drained Dixboro, Ithaca, Selfridge, and Ceresco soils. The Corunna, Lenawee, and Lamson soils are on flats and in depressions in a position similar to that of the Parkhill soils. The Sloan, Ceresco, and Cohoctah soils are on flood plains. The Dixboro, Ithaca, and Selfridge soils are in a position similar to that of the Capac and Metamora soils.

Most of the acreage is in cultivated crops. Some areas are used for pasture, permanent vegetation, and woodland. Most areas have been cleared and drained, but some swampy areas remain undrained. Wetness is the main limitation to use of the soils for farming and for most nonfarm purposes.

The soils, if adequately drained, have good potential for cultivated crops. Wetness is such a severe limitation and so difficult to overcome that the potential for residential and most other engineering uses is poor. The potential for development of habitat for wetland wildlife is good.

Nearly level, somewhat poorly drained to very poorly drained, mainly loamy sands

4. Tedrow-Selfridge-Parkhill

Nearly level, somewhat poorly drained to very poorly drained soils that have a sandy or loamy subsoil; formed mainly in glacial lake sediment

This map unit consists of nearly level soils on till plains that were modified by glacial lake waters. It occupies about 12 percent of the county. It is about 30 percent Tedrow and similar soils, 20 percent Selfridge and similar soils, and 7 percent Parkhill and similar soils. Soils of minor extent make up the rest.

Tedrow soils are nearly level and are somewhat poorly drained. The surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsoil is mottled loose sand about 36 inches thick. The upper part of the subsoil is yellowish brown, the middle part is brown, and the lower part is pale brown. The substratum, to a depth of 60 inches, is light brownish gray, calcareous sand.

Selfridge soils are nearly level and are somewhat poorly drained. The surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsoil is mottled, and it is about 27 inches thick. The upper part of the subsoil is brown, very friable loamy sand; the middle part is light yellowish brown, loose sand; and the lower part is brown, friable loam. The substratum, to a depth of 60 inches, is grayish brown and brown, mottled, calcareous clay loam.

Parkhill soils are nearly level and are poorly drained and very poorly drained. They are slightly lower in elevation than the Selfridge and Tedrow soils. The surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is mottled, firm clay loam, and it is about 27 inches thick. The upper part of the subsoil is grayish brown, and the lower part is gray. The substratum, to a depth of 60 inches, is gray and yellowish brown, mottled, calcareous loam.

The minor soils are somewhat poorly drained Capac, Dixboro, and Metamora soils; poorly drained and very poorly drained Belleville, Lamson, and Corunna soils; excessively drained Plainfield soils; and well drained Boyer soils. The Capac, Dixboro, and Metamora soils are in a position similar to that of the Tedrow and Selfridge soils. The Belleville, Lamson, and Corunna soils are in a position similar to that of the Parkhill soils. The Plainfield and Boyer soils are higher in elevation than the Tedrow and Selfridge soils. They generally are on narrow ridges.

Most of the acreage is in cultivated crops. Some areas are used for pasture, native vegetation, and woodland. Most areas have been cleared and drained, but some swampy areas remain undrained. Wetness is the main limitation to use of the soils for farming and for most nonfarm purposes. Droughtiness and soil blowing also are problems in areas of Tedrow soils.

The soils, if adequately drained, generally have fair to poor potential for cultivated crops. Wetness is such a severe limitation that the potential for residential and most other engineering uses is poor. The potential for development of habitat for wetland wildlife is poor for Tedrow and Selfridge soils and good for the Parkhill soils.

5. Sickles-Arkona-Lenawee

Nearly level, very poorly drained to somewhat poorly drained soils that have a sandy to clayey subsoil; formed in glaciolacustrine deposits

This map unit consists of nearly level soils on old glacial lakebeds. It occupies about 2 percent of the county. It is about 57 percent Sickles and similar soils, 23 percent Arkona and similar soils, and 16 percent Lenawee and similar soils. Soils of minor extent make up the rest.

Sickles soils are nearly level and are poorly drained and very poorly drained. The surface layer is black loamy sand about 9 inches thick. The substratum, to a depth of 25 inches, is dark gray, very friable loamy sand, and to a depth of 36 inches it is gray, loose sand. Below that, the substratum, to a depth of 60 inches, is gray, calcareous silty clay.

Arkona soils are nearly level, and are somewhat poorly drained. They are mostly in slightly higher places than the Sickles and Lenawee soils. The surface layer is very dark grayish brown loamy sand about 10 inches thick. The subsurface layer is light grayish brown sand about 2 inches thick. The subsoil is mottled, and it is about 29 inches thick. The upper part of the subsoil is dark brown, brownish yellow, and pale brown, loose sand; and the lower part is light grayish brown, very firm silty clay. The substratum, to a depth of 60 inches, is grayish brown, mottled, calcareous silty clay.

Lenawee soils are nearly level and are poorly drained and very poorly drained. The surface layer is very dark grayish brown clay loam about 9 inches thick. The subsoil is about 28 inches thick. The upper part is dark gray, firm clay loam; and the lower part is gray, mottled, very firm clay loam. The substratum, to a depth of 60 inches, is gray, mottled, calcareous clay loam and clay.

The minor soils are well drained and moderately well drained Oakville soils, somewhat poorly drained Tedrow soils, poorly drained and very poorly drained Kingsville and Lamson soils, and very poorly drained Wauseon soils. The Oakville soils are on slightly higher ridges than the Arkona soils. The Tedrow soils are in a position similar to that of the Arkona soils. The Kingsville, Wauseon, and Lamson soils are in a position similar to that of Sickles and Lenawee soils.

Most of the acreage is woodland and grassland. A few areas are in cultivated crops or pasture. Some areas have been cleared and drained, but most swampy areas remain undrained. Wetness is the main limitation to use of the soils for farming and for most nonfarm purposes.

The soils, if adequately drained, have generally fair potential for cultivated crops. Wetness is such a severe limitation and so difficult to overcome that the potential for residential and most other engineering uses is poor.

The potential for development of habitat for wetland wildlife is good.

Nearly level to gently sloping, well drained to somewhat poorly drained cobbly sandy loams and cobbly loamy sands

6. Capac Variant-Metea Variant

Nearly level to gently sloping, somewhat poorly drained to well drained soils that have a sandy or loamy subsoil with many cobbles; formed in glacial till and glaciofluvial deposits

This map unit consists of nearly level to gently sloping soils on glacial till plains. It occupies about 2 percent of the county. It is about 45 percent Capac Variant and similar soils and 15 percent Metea Variant and similar soils. Soils of minor extent make up the rest.

Capac Variant soils are nearly level and are somewhat poorly drained. The surface layer is very dark grayish brown cobbly sandy loam about 8 inches thick. The subsurface layer is brown, mottled, cobbly sandy loam about 6 inches thick. The subsoil is brown, mottled, firm cobbly clay loam about 11 inches thick. The substratum, to a depth of 60 inches, is brown, mottled, calcareous loam.

Metea Variant soils are gently sloping and are well drained and moderately well drained. They are in higher places than the Capac Variant soils, mainly on narrow ridges. The surface layer is very dark gray, cobbly loamy sand about 7 inches thick. The subsoil is about 30 inches thick. The upper part of the subsoil is dark brown, very friable cobbly loamy sand; the middle part is dark yellowish brown, very friable loamy sand; and the lower part is yellowish brown, firm loam. The substratum, to a depth of 60 inches, is brown loam.

The minor soils are poorly drained and very poorly drained Parkhill and Corunna soils; somewhat poorly drained Selfridge and Tedrow, loamy substratum, soils; well drained Boyer soils; and well drained and moderately well drained Marlette soils. The Parkhill and Corunna soils are in narrow depressions in slightly lower places than the Capac Variant soils. The Selfridge and Tedrow, loamy substratum, soils, are in a position similar to that of the Capac Variant soils. The Boyer soils are in a position similar to that of the Metea Variant soils, and the Marlette soils are mainly on side slopes along drainageways and flood plains.

Most of the acreage is woodland and idle grassland. A few areas are used for cropland or pasture. There is very little drainage in this area. Wetness and cobbles are the main limitations to use of the soils for farming and for most nonfarm purposes.

The soils have good potential for woodland. The potential for most recreational uses, cropland, and development of habitat for woodland and openland wildlife is poor. Wetness in the Capac Variant soils is such a severe limitation and so difficult to overcome that the potential for residential and other engineering uses is poor. On the higher Metea Variant soils, the potential for residential uses is fair.

Nearly level to gently sloping, well drained to very poorly drained loamy sands and fine sands

7. Kingsville-Pipestone-Oakville

Nearly level to gently sloping, very poorly drained to well drained soils that have a sandy subsoil; formed in glaciofluvial deposits

This map unit consists of nearly level and gently sloping soils on old glacial lakebeds. It occupies about 3 percent of the county. It is about 41 percent Kingsville and similar soils, 34 percent Pipestone and similar soils, and 18 percent Oakville and similar soils. Soils of minor extent make up the rest.

Kingsville soils are nearly level and are very poorly drained and poorly drained. These soils are in broad, flat areas. They are lower in elevation than the Pipestone and Oakville soils. The surface layer is black loamy sand about 6 inches thick. The substratum, to a depth of 60 inches, is dark gray and gray sand.

Pipestone soils are nearly level and somewhat poorly drained, and are in broad areas. The surface layer is very dark grayish brown loamy sand about 6 inches thick. The subsurface layer is light gray sand about 3 inches thick. The subsoil is mottled loose sand about 35 inches thick. The upper part of the subsoil is dark brown, the middle part is light yellowish brown, and the lower part is brown. The substratum, to a depth of 60 inches, is grayish brown, mottled sand.

Oakville soils are nearly level and gently sloping and are moderately well drained and well drained. They are on narrow, convex ridges. The surface layer is very dark grayish brown fine sand about 6 inches thick. The subsoil is yellowish brown and brownish yellow, loose fine sand about 19 inches thick. The substratum, to a depth of 60 inches, is light yellowish brown fine sand.

The minor soils are poorly drained and very poorly drained Sickles and Lenawee soils and very poorly drained Adrian soils. These soils are in a position on the landscape similar to that of Kingsville soils.

Most of the acreage is used as habitat for woodland and wetland wildlife. Wetness and low available water capacity are the main limitations to use of the soils for farming and for most nonfarm purposes. Flooding and ponding are common on Kingsville soils. Wetness is such a severe limitation and so difficult to overcome that the potential for residential and most other engineering uses is poor.

8. Vestaburg-Tedrow-Boyer

Nearly level to gently sloping, very poorly drained to well drained soils that have a sandy or loamy subsoil; formed in outwash deposits

This map unit consists of nearly level to gently sloping soils on outwash plains. It occupies about 12 percent of the county. It is about 23 percent Vestaburg and similar soils, 16 percent Tedrow and similar soils, and 14 percent Boyer and similar soils. Soils of minor extent make up the rest.

Vestaburg soils are nearly level and poorly drained and very poorly drained. They are slightly lower in elevation than the Tedrow and Boyer soils. The surface layer is very dark brown loamy sand about 8 inches thick. The substratum, to a depth of 60 inches, is gray, mottled sand in the upper part and grayish brown, calcareous gravelly sand in the lower part.

Tedrow soils are nearly level and are somewhat poorly drained. The surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsoil is mottled loose sand, and it is about 36 inches thick. The upper part of the subsoil is yellowish brown, the middle part is brown, and the lower part is pale brown. The substratum, to a depth of 60 inches, is light brownish gray, calcareous sand.

Boyer soils are nearly level and gently sloping and well drained. The surface layer is dark grayish brown loamy sand about 8 inches thick. The subsurface layer is yellowish brown loamy sand about 6 inches thick. The subsoil is about 10 inches thick. The upper part of the subsoil is yellowish brown, very friable loamy sand, and the lower part is dark brown, friable sandy loam. The substratum, to a depth of 60 inches, is brown, calcareous gravelly sand.

The minor soils are poorly drained and very poorly drained Cohoctah and Tobico soils; very poorly drained Adrian, Edwards, Houghton, Martisco, and Gilford soils; and somewhat poorly drained Ceresco and Selfridge soils. The Cohoctah, Ceresco, and some Adrian soils are on the flood plains. The Adrian, Tobico, Houghton, Edwards, Martisco, and Gilford soils are in a position similar to that of the Vestaburg soils or they are in small depressions. The Selfridge soils are in a position similar to that of the Tedrow soils.

Most of the acreage is idle grassland. Some areas are woodland and a few are used for cropland. Drainage is obtained primarily by open ditches. Most areas have been cleared and drained, but some swampy areas remain undrained. Wetness, soil blowing, and low available water capacity are the main concerns for farmers. Wetness and seepage are the main limitations to most nonfarm uses. Ponding is common on the soils in a lower position on the landscape.

The soils have fair to poor potential for cultivated crops, but with irrigation, they have good potential for specialty crops. The higher Tedrow and Boyer soils have fair to good potential for woodland, pasture, and development of habitat for woodland wildlife. The Boyer soils have good potential for residential uses; however, seepage from septic tank absorption fields can result in contamination of shallow water supplies. The potential for most engineering uses is poor for very poorly drained to somewhat poorly drained soils and good for other soils.

Nearly level to gently rolling, well drained to somewhat poorly drained loams and sandy loams

9. Perrinton-Ithaca

Nearly level to gently rolling, well drained to somewhat poorly drained soils that have a loamy or clayey subsoil; formed in glacial till

This map unit consists of nearly level to gently rolling soils on moraines. It occupies about 6 percent of the county. It is about 43 percent Perrinton and similar soils and 37 percent Ithaca and similar soils. Soils of minor extent make up the rest.

Perrinton soils are gently sloping to gently rolling and are moderately well drained and well drained. They are generally higher in elevation than the Ithaca soils. The surface layer is very dark grayish brown loam about 8 inches thick. The upper part of the subsoil is mixed brown clay loam and grayish brown loam about 6 inches thick. The lower part is yellowish brown, very firm clay and firm clay loam about 18 inches thick. The substratum, to a depth of 60 inches, is brown, calcareous clay loam.

Ithaca soils are nearly level and are somewhat poorly drained. The surface layer is very dark grayish brown loam about 9 inches thick. The upper part of the subsoil is mixed, friable brown clay loam and grayish brown loam about 4 inches thick. The lower part is brown, mottled, very firm clay loam about 16 inches thick. The substratum, to a depth of 60 inches, is brown, mottled, calcareous clay loam.

The minor soils are poorly drained and very poorly drained Lenawee soils and very poorly drained Palms and Houghton soils, in small depressions or in narrow drainageways. The somewhat poorly drained Arkona and Metamora soils are in a position on the landscape similar to that of the Ithaca soils, and the Metea soils are in a position similar to that of the Perrinton soils.

Most of the acreage is in cultivated crops. Some areas are used for pasture or are woodland. Most areas have been cleared and drained, but a few swampy areas remain undrained. Wetness and slope are the main limitations to use of the soils for farming and most nonfarm purposes.

The soils, if adequately drained and protected from erosion, have good to fair potential for cultivated crops, woodland, and development of habitat for openland and woodland wildlife. The potential for residential and most other engineering uses is poor for somewhat poorly drained soils and good for moderately well drained and well drained soils.

10. Marlette-Capac

Nearly level to gently rolling, well drained to somewhat poorly drained soils that have a loamy subsoil; formed in glacial till

This map unit consists of nearly level to gently rolling soils on moraines. It occupies about 7 percent of the county. It is about 55 percent Marlette and similar soils and 24 percent Capac and similar soils. Soils of minor extent make up the rest.

Marlette soils are gently sloping to gently rolling and are moderately well drained and well drained. They are generally higher in elevation than the Capac soils. The surface layer is dark grayish brown sandy loam about 10 inches thick. The subsurface layer is pale brown sandy loam about 4 inches thick. The subsoil is friable and is about 20 inches thick. The upper part of the subsoil is mixed, yellowish brown loam and pale brown sandy loam, the middle part is brown clay loam, and the lower part is strong brown loam. The substratum, to a depth of 60 inches, is brown, mottled, calcareous loam.

Capac soils are nearly level and are somewhat poorly drained. The surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is mottled, firm clay loam about 20 inches thick. The upper part of the subsoil is yellowish brown, the middle part is light yellowish brown, and the lower part is brown. The substratum, to a depth of 60 inches, is grayish brown, mottled, calcareous loam.

The minor soils are poorly drained and very poorly drained Parkhill and Corunna soils, very poorly drained Palms soils, somewhat poorly drained Selfridge and Metamora soils, and well drained Metea and Arkport soils. The Parkhill, Corunna, and Palms soils are in depressions and in a lower position on the landscape than the Capac soils. The Selfridge and Metamora soils are in a position similar to that of the Capac soils. The Metea and Arkport soils are in a position similar to that of the Marlette soils.

Most of the acreage is in cultivated crops. Some areas are used for pasture or are woodland. Most areas have been cleared and drained, but a few swampy areas remain undrained. Wetness and slope are the main limitations to use of the soils for farming and most nonfarm purposes.

The soils, if adequately drained and protected from erosion, have good to fair potential for cultivated crops, woodland, and development of habitat for openland and woodland wildlife. The potential for residential and most other engineering uses is poor for somewhat poorly drained soils and good for well drained soils.

Nearly level to gently rolling, well drained loamy fine sands and loamy sands

11. Arkport-Spinks-Boyer

Nearly level to gently rolling, well drained soils that have a sandy or loamy subsoil formed in glaciofluvial deposits

This map unit consists of nearly level to gently rolling soils mostly on moraines. It occupies about 2 percent of the county. It is about 44 percent Arkport and similar soils, 20 percent Spinks and similar soils, and 14 percent Boyer and similar soils. Soils of minor extent make up the rest.

Arkport soils are nearly level to gently rolling and are well drained. The surface layer is very dark grayish brown loamy fine sand about 9 inches thick. The subsurface layer is yellowish brown loamy fine sand about 13 inches thick. The subsoil is stratified, dark yellowish brown, friable loam and light gray loamy fine sand about 8 inches thick. The substratum, to a depth of 60 inches, is stratified, sandy and loamy sediment that ranges from very pale brown to dark yellowish brown.

Spinks soils are nearly level to gently rolling and are well drained. They are often slightly higher in elevation than the Arkport soils. The surface layer is dark grayish brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, loose sand about 11 inches thick. The next layer is yellowish brown, loose sand with bands of dark brown, very friable loamy sand about 26 inches thick. The substratum, to a depth of 60 inches, is pale brown sand.

Boyer soils are nearly level and gently sloping and are well drained. They are generally in a position similar to that of the Arkport soils. The surface layer is dark grayish brown loamy sand about 8 inches thick. The subsurface layer is yellowish brown loamy sand about 6 inches thick. The subsoil is about 10 inches thick. The upper part of the subsoil is yellowish brown, very friable loamy sand, and the lower part is dark brown, friable sandy loam. The substratum, to a depth of 60 inches, is brown, calcareous gravelly sand.

The minor soils are poorly drained and very poorly drained Lamson and Cohoctah soils, very poorly drained Adrian and Houghton soils, somewhat poorly drained Dixboro and Riverdale soils, and well drained Metea soils. The Lamson, Adrian, and Houghton soils are the lowest in elevation, generally in depressions and the Cohoctah soils and some Adrian soils are on flood plains. The Dixboro and Riverdale soils are slightly higher in elevation than the Lamson soils. The Metea soils are in a position similar to the Arkport soils.

Most of the acreage is in cultivated crops. Some areas are used for woodland or idle grassland. Some swampy areas remain undrained. Seepage, droughtiness, and slope are the main limitations for farming and most nonfarm purposes.

The soils, if protected from erosion, have fair to good potential for cultivated crops. The potential for specialty crops, woodland, residential uses, pasture, and development of habitat for woodland wildlife is good. Seepage of septic tank absorption fields can result in contamination of shallow water supplies. The potential for most engineering uses is good.

Nearly level, very poorly drained and poorly drained silty clay loams and mucks

12. Saranac-Houghton

Nearly level, poorly drained and very poorly drained soils that have a clayey subsoil and organic soils; formed in clayey alluvial sediment or in organic sediment

This map unit consists of nearly level soils on the flood plain. It occupies about 2 percent of the county. It is about 60 percent Saranac and similar soils and 29 percent Houghton and similar soils. Soils of minor extent make up the rest.

Saranac soils are nearly level and are poorly drained and very poorly drained. The surface layer is very dark gray silty clay loam about 12 inches thick. The subsurface layer is dark gray silty clay loam about 11 inches thick. The subsoil is gray, mottled, very firm silty clay about 14 inches thick. The substratum, to a depth of 60 inches, is very dark brown silty clay loam in the upper part, gray silty clay in the middle part, and dark gray silty clay in the lower part.

Houghton soils are nearly level and are very poorly drained. The surface layer is black muck about 12 inches thick. The substratum, to a depth of 60 inches, is very dark brown and brown muck.

The minor soils are poorly drained and very poorly drained Lenawee soils, very poorly drained Palms and Adrian soils, and somewhat poorly drained Pert and Arkona soils. The Lenawee, Toledo, Palms, and Adrian soils are in a position similar to Saranac and Houghton soils. The Pert and Arkona soils are slightly higher in elevation than the Saranac and Houghton soils.

Most of the acreage is used for wetland wildlife habitat. A few areas are in cultivated crops. Some areas have been cleared and drained, but most swampy areas remain undrained. Wetness and flooding are the main limitations to use of the soils for farming and for most nonfarm purposes.

The soils have good potential for development of habitat for wetland wildlife. They have poor potential for woodland, cropland, and pasture. Wetness and hazard of flooding are such severe limitations and so difficult to overcome that the potential for residential and other engineering uses is poor.

Broad land use considerations

Gratiot County has an abundance of good farmland. It is among the leading counties in Michigan for farm products. Each year some of the farmland is changed to other uses such as houses, roads, and industry. Information in this survey will help plan future land use to provide adequate land for all needs. Also, information about soil limitations for given uses helps prevent major mistakes in land use and unnecessary costs to individuals and to the community.

The general soil map is helpful in broad land use planning. It provides a basis for comparing the potential of large areas of the county for general kinds of land use. In general, the soils that have good potential for cultivated crops have poor potential for urban development. For example, Parkhill-Corunna and Capac-Parkhill-Metamora map units have much good cropland, but wetness is a severe limitation to urban development. The soils of the Vestaburg-Tedrow-Boyer map unit, parts of the Tedrow-Selfridge-Parkhill map unit, and the less sloping parts of the Arkport-Spinks-Boyer map unit are uniquely suited to vegetables and other specialty crops. These soils warm earlier in spring than the more clayey, wetter soils. They are also well suited to nurseries.

Most of the soils of the county have good or fair potential for woodland, except the Saranac-Houghton map unit on which trees either do not grow naturally or produce poor wood crops. Commercially valuable trees are less common and generally do not grow so rapidly on the wetter soils of Lenawee-Toledo-Pert, Parkhill-Corunna, and Sickles-Arkona-Lenawee map units as they do on soils of other map units.

Many soils in the county have a wetness limitation for urban development, especially those in the Lenawee-Toledo-Pert, Parkhill-Corunna, Capac-Parkhill-Metamora, Tedrow-Selfridge-Parkhill, Sickles-Arkona-Lenawee, and Saranac-Houghton map units. In addition, many parts of the Marlette-Capac, Perrinton-Ithaca, and Vestaburg-Tedrow-Boyer map units have a wetness limitation. Parts of the Perrinton-Ithaca map unit have poor potential for urban development, because of the shrink-swell potential.

The hilly parts of the Marlette-Capac, Perrinton-Ithaca, and Arkport-Spinks-Boyer map units are excellent for parks and extensive recreation areas, nature study areas, and wilderness uses. Hardwood forests enhance the beauty of parts of these map units. Undrained marshes and swamps of the Vestaburg-Tedrow-Boyer, Arkport-Spinks-Boyer, Capac Variant-Metea Variant, Saranac-Houghton, Kingsville-Pipestone-Oakville, and Sickles-Arkona-Lenawee map units are good for nature study areas. All of these provide habitat for many important species of wildlife.

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 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.

At the end of each description of a map unit, the capability subclass and Michigan soil management group in which the map unit has been placed are identified. For a soil complex, the soil management groups are listed in the order that the soils appear in the name of the map unit. These groups are used for making recommendations about applications of lime and fertilizer, artificial drainage, and other practices. For an explanation of these groups, refer to Michigan State University Extension Bulletin 254, "Soil management units and land use planning" (*5*).

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 in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Ithaca series, for example, was named for the town of Ithaca in Gratiot County.

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, Spinks loamy sand, 0 to 6 percent slopes, is one of several phases within the Spinks 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. Toledo-Sickles complex 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. Pits 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 additional 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.

Ad—Adrian muck. This is a nearly level, very poorly drained soil on lowlands and flood plains. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 300 acres in size.

Typically, black muck extends to a depth of about 34 inches. The substratum, to a depth of 60 inches, is gray, calcareous sand.

Included with this soil in mapping are small areas of Palms, Edwards, and Houghton soils and some soils that have a thin layer of mucky peat. The Palms soils generally are in narrow, discontinuous areas along the edges of mapped areas of this unit, and they make up 2 to 12 percent of the mapped areas. They have a loamy substratum that has moderately slow permeability. The Edwards and Houghton soils make up 8 to 16 percent of the mapped areas. They have higher available water capacity in the lower part of the profile than this Adrian soil.

Permeability is moderately slow to moderately rapid in the organic material and rapid in the underlying sand. The available water capacity is very high. Runoff is very slow or ponded.

This soil is mostly in native vegetation, including trees. In a few areas, it is used for unimproved pasture or for crops. This soil has good potential for pasture and for wetland wildlife habitat. It has fair potential for crops and poor potential for woodland.

If this soil is properly drained and protected from soil blowing, it is suited to specialty crops, for example, potatoes, carrots, onions, and mint. Soil blowing, frost action, and flooding are the major hazards. The hazards of soil blowing and frost can be reduced by sprinkler irrigation. Soil blowing can also be reduced by controlling the water table and by using buffer strips, cover crops, and windbreaks. Flooding can be reduced by lowering the water table through artificial drainage or by constructing dikes. Lift pumps must be installed in areas that lack adequate drainage outlets.

If this soil is used for pasture, removing excess water is the major management requirement. Grazing is restricted during wet periods. Artificial drainage can be used to remove excess water. Pasture plants that are tolerant of wetness must be selected.

If this soil is used for trees, productivity is variable but is generally low. Windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are major management problems. Seedling losses are high, and trees may blow down during storms. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses because of wetness, frost action, seepage, and excess humus. The areas of mucky peat, which were included in mapping, are better suited to roads and to buildings than this soil. Capability subclass IVw, Michigan soil management group M/4c.

AfA—Aquents-Udorthents complex, 0 to 3 percent slopes. This map unit consists of nearly level areas where sandy and loamy materials have been excavated. A few included areas have been filled with loamy soil materials, ranging from sand to clay loam.

Drainage, permeability, available water capacity, reaction, and texture are too variable to rate in these areas.

Most areas are in permanent vegetation. A few areas have houses built on them. Onsite investigation is needed to determine the potential of these areas for development of wildlife habitat, for cropland, woodland, or recreational uses.

The use of these areas for urban development also requires onsite investigation to determine the type of limitation for a specific use. Using surface ditches and tile drains and connecting sanitary facilities to commercial sewers and treatment facilities can help to overcome wetness. In areas where sewage lagoons and sanitary landfills cause seepage, a sealer or restrictive layer of impervious materials can be used.

AkA—Arkona loamy sand, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges. It is subject to rare flooding. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 80 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 10 inches thick. The subsurface layer is light grayish brown sand about 2 inches thick. The subsoil is mottled, and it is about 29 inches thick. The upper part of the subsoil is dark brown, brownish yellow, and pale brown, loose sand 23 inches thick. The lower part is light grayish brown, very firm silty clay 6 inches thick. The substratum, to a depth of 60 inches, is grayish brown, mottled, calcareous silty clay. In some places, the sandy material is less than 20 inches thick. Also, in some places, the dark brown layer in the upper part of the subsoil is absent.

Included with this soil in mapping are small areas of Pert and Ithaca soils on low knolls and ridges. These soils make up 5 to 10 percent of the mapped areas. They have a higher available water capacity than this Arkona soil. Also included are some small areas of very poorly drained and poorly drained Wauseon, Lenawee, and Sickles soils in depressions and drainageways; they make up 1 to 8 percent of the mapped areas. Some small areas of well drained and moderately well drained soils on slightly higher elevations are also included.

Permeability is rapid in the sandy upper part and slow in the clayey lower part. The available water capacity is low. Runoff is slow.

This soil is used mostly for crops. In a few areas, it is in native vegetation, including trees. This soil has fair potential for crops, woodland, and as habitat for openland and woodland wildlife. It has good potential for pasture.

If this soil is used for cultivated crops, removing excess water in wet periods, conserving moisture in dry periods, controlling soil blowing, and maintaining high organic-matter content are major management requirements. Artificial drainage must be installed to remove excess water. Minimum tillage and stubble mulching and the use of cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, wetness in spring and droughtiness in dry summers are major management problems. Grazing is restricted in wet periods and growth is reduced in dry periods.

If this soil is used for trees, seedling losses can be high because of the sandy surface layer.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches or tile drains. Dwellings and small commercial buildings with basements should not be constructed on this soil. Footings and foundations should be designed so that frost action and shrink-swell potential do not cause structural damage. The included areas of well drained or moderately well drained soils are slightly higher in elevations and are better suited to some urban uses than this soil. Capability subclass IIIw, Michigan soil management group 4/1b.

ArB—Arkport loamy fine sand, 1 to 6 percent slopes. This is a nearly level and gently sloping well drained soil on foot slopes, knolls, and ridges. Slopes are smooth or convex and are less than 100 feet long. The areas are irregular in shape and are 2 to 200 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 9 inches thick. The subsurface layer is yellowish brown loamy fine sand about 13 inches thick. The subsoil is about 8 inches thick. It is stratified, dark yellowish brown, friable loam and light gray, very friable loamy fine sand. The substratum, to a depth of 60 inches, is stratified sandy and loamy sediment that ranges from very pale brown to dark yellowish brown. In places, the subsoil has a higher clay content and in other places, the substratum is gravelly sand.

Included with this soil in mapping are small areas of somewhat poorly drained Dixboro soils and well drained Spinks soils. The Spinks soils have lower available water capacity than this Arkport soil. They generally are on steeper slopes at a higher elevation than this Arkport soil; they make up 5 to 20 percent of the mapped areas. The Dixboro soils are on low knolls and ridges at a lower elevation than this Arkport soil; they make up 1 to 8 percent of the mapped areas. Also included are small areas of a soil similar to the Arkport soil, except it is moderately well drained. These areas are generally slightly lower in elevation than this Arkport soil and are on foot slopes or in valleys.

Permeability is moderately rapid, and the available water capacity is moderate. Runoff is slow.

This soil is used mostly for crops. In a few areas, it is in native vegetation, including trees. This soil has good potential for crops, pasture, woodland, recreational use, and as habitat for openland and woodland wildlife.

If this soil is used for cultivated crops, erosion and droughtiness are moderate hazards. Controlling erosion and maintaining high organic-matter content and fertility level are major management requirements. Practices that reduce erosion and conserve moisture are the use of crop rotations with hay, the use of cover crops, and minimum tillage. In a few areas, the slopes are sufficiently long and smooth for terracing and contour farming. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Legumes need additional applications of lime.

If this soil is used for pasture, droughtiness is the major hazard. The use of deep-rooted, drought-resistant plants helps to overcome this problem.

If this soil is used for trees, seedling mortality and plant competition are moderate management problems. Moderate loss of seedlings may occur in dry summers. The growth of undesirable trees and shrubs delays natural and artificial regeneration and hinders the growth of fully stocked stands.

This soil has slight limitations for most engineering uses. However, sewage lagoons and sanitary landfills can cause seepage. In shallow excavations, cutbanks cave in. A sealer or restrictive layer of impervious material will prevent seepage. Constructing retaining walls and maintaining the proper slope grade will help reduce caving of cutbanks. Capability subclass IIe, Michigan soil management group 3a-s.

ArC—Arkport loamy fine sand, 6 to 12 percent slopes. This is a moderately sloping or gently rolling, well drained soil on knolls and ridgetops. Most areas are dissected by shallow drainageways. Slopes are smooth and convex and are generally less than 100 feet long. The areas are irregular in shape and are 5 to 150 acres in size.

Typically, the surface layer is brown loamy fine sand about 8 inches thick. The subsoil is about 29 inches thick. The upper part of the subsoil is yellowish brown, very friable fine sandy loam, the middle part is light yellowish brown, very friable loamy fine sand, and the lower part is dark brown and light yellowish brown, friable, stratified sandy clay loam and sandy loam. The substratum, to a depth of 60 inches, is loamy and sandy sediment that ranges from pale brown to brownish yellow. In places, the subsoil has a higher clay content; and in other places, the substratum is gravelly sand.

Included with this soil in mapping are small areas of somewhat poorly drained Dixboro soils and well drained Spinks soils. The Spinks soils have a lower available water capacity than this Arkport soil. Also included are Metea soils that have a higher available water capacity in the lower part of the profile than this Arkport soil. The Metea and Spinks soils make up 1 to 10 percent of the mapped areas. The Dixboro soils are in narrow drainageways and valleys and on foot slopes; they make up 1 to 5 percent of the mapped areas. The Metea and Spinks soils are generally on knolls and ridgetops.

Permeability is moderately rapid, and the available water capacity is moderate. Runoff is medium.

This soil is mostly in permanent vegetation or is used for pasture. In a few areas, it is used for crops or is wooded. This soil has fair potential for crops and recreational use and as habitat for openland wildlife. It has good potential for pasture and woodland and as habitat for woodland wildlife.

If this soil is used for cultivated crops, erosion and droughtiness are moderate hazards. Controlling erosion and maintaining high organic-matter content and fertility level are major management requirements. Practices to reduce erosion and conserve moisture are the use of crop rotations with hay, the use of cover crops, and minimum tillage. In a few areas, the slopes are sufficiently long and smooth for contour farming. Frequent additions of crop residue, manure, and green manure help to maintain content of organic matter. Legumes need additional applications of lime.

If this soil is used for pasture, droughtiness is the major hazard. The use of deep-rooted, drought-resistant plants helps to overcome this problem.

If this soil is used for trees, seedling mortality and plant competition are moderate management problems. Moderate loss of plant seedlings may occur in dry summers. The growth of undesirable trees and shrubs delays natural and artificial regeneration and hinders the growth of fully stocked stands.

This soil has moderate to severe limitations for most engineering uses, because of slope, seepage, and caving of cutbanks. Methods of reducing the slope limitation include land forming and contouring roads and streets. Seepage can be reduced by using a sealer or restrictive layer of impervious material. Methods to prevent the caving of cutbanks include constructing retaining walls and maintaining the proper slope grade. Capability subclass IIIe, Michigan soil management group 3a-s.

Be—Belleville loamy sand. This is a nearly level, poorly drained and very poorly drained soil in broad, flat areas and drainageways. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 100 acres in size.

Typically, the surface layer is very dark gray loamy sand about 8 inches thick. The substratum, to a depth of 35 inches, is dark gray and gray loamy sand. Below that, to a depth of 60 inches, it is gray, calcareous clay loam. Some areas have a surface layer more than 10 inches thick.

Included with this soil in mapping are small areas of Corunna, Parkhill, and Kingsville soils in broad, flat areas and drainageways. The Corunna and Parkhill soils have a higher available water capacity in the upper part of the profile and the Kingsville soils have a lower available water capacity in the lower part of the profile than this Belleville soil. Corunna and Parkhill soils make up 5 to 15 percent of the mapped areas, and Kingsville soils make up 1 to 8 percent. Also included are small areas of somewhat poorly drained Selfridge and Metamora soils on low knolls and ridges; they make up 1 to 8 percent of the mapped areas.

Permeability is rapid in the sandy upper part and moderately slow in the loamy lower part. The available water capacity is moderate. Runoff is very slow or ponded.

This soil is used mostly for crops. In a few areas, it is used for pasture or is in native vegetation, including trees. This soil has fair potential for crops and as habitat for wetland wildlife. It has good potential for pasture and poor potential for woodland.

If this soil is used for cultivated crops, removing excess water, controlling soil blowing, and maintaining high organic-matter content are major management requirements. Artificial drainage must be installed to remove excess water. Minimum tillage and stubble mulching and the use of cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Legumes need additional applications of lime.

If this soil is used for pasture, wetness is the major limitation. Grazing is restricted in wet periods. Artificial drainage can help to remove excess water and thereby increase yields. Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, productivity is low. Because of wetness, equipment limitations, seedling mortality, windthrow hazard, and plant competition are major management problems. The use of heavy equipment for planting and harvesting trees is limited to periods when the soil is dry or frozen. Seedling losses are high, and some trees may blow down during storms. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses because of wetness, flooding, frost action, and seepage. Using surface ditches and tile drains and connecting sanitary facilities to commercial sewers and treatment facilities help overcome wetness. Foundations and footings should be designed so that frost action does not cause structural damage. For local roads or streets to function properly, the surface layer of the Belleville soil should be replaced or covered with suitable base material. Sewage lagoons and sanitary landfills cause seepage in the sandy layers. Using a sealer or restrictive layer of impervious material will help overcome this problem. Capability subclass IIIw, Michigan soil management group 4/2c.

BoB—Boyer loamy sand, 0 to 6 percent slopes. This is a nearly level and gently sloping, well drained soil on knolls and ridges. Slopes are smooth and convex and are less than 100 feet long. The areas are irregular in shape and are 2 to 320 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 8 inches thick. The subsurface layer is yellowish brown loamy sand about 6 inches thick. The subsoil is about 10 inches thick. The upper part of the subsoil is yellowish brown, very friable loamy sand; and the lower part is dark brown, friable sandy loam. The substratum, to a depth of 60 inches, is brown, calcareous gravelly sand. In some places, the thickness of the surface layer and subsoil is less than 22 inches or the soil is redder just below the surface layer.

Included with this soil in mapping are small areas of a soil similar to this Boyer soil, except it is moderately well drained. These soils are on knolls and ridges or are in shallow depressions and narrow drainageways; they make up 5 to 15 percent of the mapped areas. Also included in mapping are small areas of somewhat poorly drained Riverdale soils and very poorly drained Gilford soils. These soils are in depressions and narrow drainageways; they make up 1 to 6 percent of the mapped areas.

Permeability is moderately rapid, and available water capacity is low. Runoff is slow.

This soil is used mostly for crops, or it is in native vegetation, including trees. In a few areas, it is used for unimproved pasture. This soil has fair potential for crops. It has good potential for specialty crops, for example, small fruits and vegetables grown with irrigation; for pasture; for woodland; for recreational use; and as habitat for woodland and openland wildlife.

If this soil is used for cultivated crops, soil blowing and droughtiness are major problems. The major management requirements are controlling soil blowing, maintaining high organic-matter content, and conserving soil moisture. Minimum tillage and stubble mulching and the use of cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, droughtiness is the major hazard. Growth is reduced in dry summers. The use of deep-rooted, drought-resistant plants helps overcome this problem.

This soil has no major hazards or management problems if it is used for trees.

This soil has slight limitations for most engineering uses. However, sewage lagoons and sanitary landfills can cause seepage. Using a sealer or restrictive layer of impervious material will prevent this. Capability subclass IIIs, Michigan soil management group 4a.

CaA—Capac loam, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges. It is subject to rare flooding. Slopes are smooth and convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 600 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is mottled, firm clay loam about 20 inches thick. The upper part of the subsoil is yellowish brown, the middle part is light yellowish brown, and the lower part is brown. The substratum, to a depth of 60 inches, is grayish brown, mottled, calcareous loam. In some places, the subsoil is less than 20 inches thick and the depth to the calcareous substratum is less than 26 inches.

Included with this soil in mapping are small areas of poorly drained and very poorly drained Parkhill and Corunna soils in small depressions and narrow drainageways. These soils make up 1 to 15 percent of the mapped areas. Also included are small areas of Selfridge, Metamora, and Dixboro soils on low knolls and ridges. These soils have a lower available water capacity than this Capac soil. Selfridge and Dixboro soils make up 1 to 8 percent of the mapped areas, and Metamora soils make up 10 to 15 percent. Also included are areas of moderately well drained and slightly more sloping Marlette soils. Marlette soils are on side slopes that border drainageways, knolls, and ridgetops; they make up 1 to 8 percent of the mapped areas.

Permeability is moderate or moderately slow, and the available water capacity is high. Runoff is slow.

This soil is used mostly for crops. In a few areas, it is in native vegetation, including trees. This soil has good potential for crops, pasture, and woodland and as habitat for openland and woodland wildlife.

If this soil is used for cultivated crops, wetness is the major limitation. The main management requirements are providing adequate drainage and improving tilth. Artificial drainage can remove excess water. Tilling within the proper range of moisture content, minimum tillage, and incorporating crop residue into the plow layer help maintain good tilth.

If this soil is used for pasture, removing excess water is the major management requirement. Grazing this soil when it is wet causes compaction of the surface layer. To prevent compaction, grazing should be restricted during wet periods.

If this soil is used for trees, equipment limitations and plant competition are the main management problems. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. The sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches or tile drains. Dwellings and small buildings with basements should not be constructed on this soil. Footings and foundations should be designed so that frost action does not cause structural damage. For local roads and streets to function properly, the surface layer of Capac soil should be replaced or covered with suitable base material. The included areas of moderately well drained Marlette soils are better suited to most engineering uses than this soil because they are better drained. Capability subclass IIw, Michigan soil management group 2.5b.

CcA—Capac Variant-Parkhill complex, 0 to 2 percent slopes. This map unit consists of nearly level, somewhat poorly drained Capac Variant soil on low, domelike mounds and low ridges and of poorly drained and very poorly drained Parkhill soil in depressions and drainageways. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 100 acres in size. The Capac Variant soil makes up about 60 to 70 percent of this map unit, and the Parkhill soil makes up 20 to 28 percent. These soils are so intricately mixed or so small in extent that it was not practical to separate them at the scale used for mapping.

The Capac Variant soil is rarely flooded, and the Parkhill soil is frequently flooded. The Capac Variant soil has numerous cobbles and gravel fragments in the surface layer and subsoil (fig. 1). The Parkhill soil has gravel in the surface layer and commonly has a few cobbles and gravel fragments in the subsoil.

Typically, the surface layer of the Capac Variant soil is very dark grayish brown cobbly sandy loam about 8 inches thick. The subsurface layer is brown, mottled cobbly sandy loam about 6 inches thick. The subsoil is brown, mottled, firm cobbly clay loam about 11 inches thick. The substratum, to a depth of 60 inches, is brown, mottled, calcareous loam. In some places, where the cobbles have been removed, the surface layer is dominantly gravelly sandy loam. Also, in some places stones and boulders are in the surface layer.

Typically the surface layer of the Parkhill soil is very dark gray gravelly sandy loam about 7 inches thick. The subsoil is mottled and friable and is about 37 inches thick. The upper part of the subsoil is dark gray loam, the middle part is dark gray clay loam, and the lower part is gray clay loam. The substratum, to a depth of 60 inches, is gray, mottled, calcareous loam. In some places, the Parkhill soil has no gravel in the surface layer.

Included with these soils in mapping are small areas of poorly drained and very poorly drained Belleville and Corunna soils in depressions and drainageways. These soils make up 5 to 10 percent of the mapped areas. Also included are small areas of Selfridge and Metamora soils on low, domelike mounds and low ridges. These soils have a lower available water capacity than the Capac Variant soil and are in similar positions on the landscape. They make up 10 to 15 percent of the mapped areas.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is slow to ponded.

These soils are used mostly for pasture or are in native vegetation, including trees. In a few areas, they are used for crops. These soils have poor potential for crops and good potential for pasture and woodland. They have good to fair potential as habitat for openland, woodland, and wetland wildlife. They have poor potential for most recreation uses.

These soils generally are not cultivated. The major limitations to their use for crops are cobbles and wetness.

If these soils are used for pasture, the major management problems are cobbles and wetness. Cobbles must be removed if they hinder fieldwork. Artificial drainage can help to remove excess water and thereby increase yields. Restricting grazing during wet periods helps prevent compaction of the surface layer.

If these soils are used for trees, windthrow is a moderate hazard on the Parkhill soil. The major management problems are equipment limitations, seedling mortality, and plant competition. The use of heavy equipment is limited to periods when the soils are dry or frozen. Losses of seedlings will be high on the Parkhill soil because of wetness. The sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

These soils have severe limitations for most engineering uses. For such uses, they must be artificially drained by using surface ditches or tile drains. Footings and foundations should be designed so that frost action does not cause structural damage. For local roads and streets to function properly, the surface layer of the Capac Variant soil should be replaced or covered with suitable base material. Capability subclass VIw, Michigan soil management group Gbc.

Ce—Ceresco fine sandy loam, gravelly substratum. This is a nearly level, somewhat poorly drained soil on flood plains. It is subject to frequent flooding. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 200 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 11 inches thick. The subsoil is mottled and very friable, and it is about 21 inches thick. The upper part of the subsoil is yellowish brown fine sandy loam 15 inches thick, and the lower part is brown loamy fine sand 6 inches thick. The substratum, to a depth of 38 inches, is grayish brown, calcareous sandy loam. Below that, it is gravelly sand.

Included with this soil in mapping are small areas of poorly drained and very poorly drained Cohoctah and Sloan soils in depressions; they make up 1 to 10 percent of the mapped areas. Also included are small areas of soils similar to the Ceresco soil, except that they have a coarser or finer textured subsoil; they make up 5 to 12 percent of the mapped areas. Cohoctah soils have a lower available water capacity, and Sloan soils have a higher available water capacity than the Ceresco soil.

Permeability is moderate to moderately rapid, and the available water capacity is low. Runoff is very slow.

This soil is mostly in native vegetation, including trees. In a few areas, it is used for crops. This soil has fair potential for crops and pasture. It has good potential for woodland and as habitat for openland and woodland wildlife.

If this soil is used for cultivated crops, the major hazard is flooding. The major management requirement is removal of excess water. Artificial drainage can be used and thereby increase crop yields. Lift pumps must be installed in areas that lack adequate drainage outlets. The construction of dikes can be used to prevent flooding, but the cost may prohibit this method. Tilling within the proper range of moisture content helps maintain good tilth.

If this soil is used for pasture, flooding is the major hazard. Removing excess wetness is the major management requirement. Grazing when this soil is flooded or wet causes compaction of the surface layer. Grazing should be restricted in wet periods to maintain good tilth. Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, equipment limitations and plant competition are the main management problems. The use of heavy equipment for planting and harvesting trees should be restricted in wet periods. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses because of flooding, wetness, and high potential frost action. For local roads or streets to function properly, the surface layer of Ceresco soil should be replaced or covered with suitable base material. This will overcome the hazard of frost action. Capability subclass IIIw, Michigan soil management group L-2c.

Ch—Cohoctah fine sandy loam, gravelly substratum. This is a nearly level, poorly drained and very poorly drained soil on flood plains. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 200 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 12 inches thick. The substratum, to a depth of 37 inches, is dark gray, gray, and very dark brown, mottled, fine sandy loam and sandy loam. Below that, to a depth of 60 inches, it is gray sand and gravelly coarse sand.

Included with this soil in mapping are small areas of Ceresco and Sloan soils. The somewhat poorly drained Ceresco soil is on low knolls and ridges on the flood plains; they make up 5 to 10 percent of the mapped areas. The Sloan soils are on flood plains; they make up 1 to 5 percent of the mapped areas. They have a higher available water capacity than this Cohoctah soil. Also included are small areas that are coarser textured than this Cohoctah soil; they make up 10 to 15 percent of the mapped areas. These soils have a lower available water capacity than the Ceresco soil.

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

This soil is mostly in native vegetation, including trees. In a few areas, it is used for crops. This soil has poor potential for crops and pasture. It has good potential for woodland and as habitat for wetland wildlife.

If this soil is used for cultivated crops, flooding and frost action are the major hazards. Wetness and lack of adequate drainage outlets are major management problems. Construction of dikes and installation of artificial drainage and lift pumps reduce some of these problems. These methods are generally not economically feasible.

If this soil is used for pasture, flooding is the major hazard. This soil will flood or have excess water throughout much of the year. Grazing should be restricted in wet periods. Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, windthrow and flooding are major hazards. Equipment limitations, seeding mortality, and plant competition are major management problems. Flooding or wetness will result in trees blowing down during storms, heavy losses to plant seedlings, and restricted use of heavy equipment for planting and harvesting trees. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For local roads and streets to function properly, the surface layer of the Cohoctah soil should be covered with suitable base material. Capability subclass Vw, Michigan soil management group L-2c.

Co—Cohoctah-Ceresco fine sandy loams, gravelly substratum. This map unit consists of nearly level, very poorly drained and poorly drained Cohoctah soils and somewhat poorly drained Ceresco soils. It is about 40 to 55 percent Cohoctah soils and 20 to 35 percent Ceresco soils. These soils are on the flood plains. They are subject to frequent flooding. They are so intricately mixed, or so small in extent, that it is not practical to map them separately. The Cohoctah soil is in flat depressions, the Ceresco soil is on low mounds and ridges. The areas are long, narrow, and winding, following the river, and they are 10 to 1,000 acres in size.

Typically, the surface layer of the Cohoctah soil is very dark grayish brown fine sandy loam about 12 inches thick. The substratum, to a depth of 37 inches, is mottled, dark gray, gray, and very dark brown fine sandy loam and sandy loam. Below that, to a depth of 60 inches, it is gray sand and gravelly coarse sand.

Typically, the surface layer of the Ceresco soil is very dark grayish brown fine sandy loam about 11 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is yellowish brown, mottled, very friable fine sandy loam 15 inches thick; and the lower part is mottled, pale brown loamy fine sand 6 inches thick. The substratum, to a depth of 38 inches, is mottled, grayish brown, calcareous sandy loam. Below that is grayish brown, calcareous gravelly sand.

Included with these soils in mapping are small areas of Sloan soils and more sandy soils. Sloan soils make up 1 to 8 percent of the mapped areas, and the more sandy soils make up 10 to 14 percent. Also included are small areas of Houghton, Adrian, and Palms soils. These small areas are on the flood plains; they make up 0 to 8 percent of the mapped areas. All of the included soils have a higher available water capacity than the Cohoctah and Ceresco soils.

Permeability is moderately rapid, and the available water capacity is low. Runoff is very slow to ponded.

Areas of these soils are mostly wooded. In a few areas, they are used for unimproved pasture, or they are idle. These soils have poor potential for crops, pasture, and woodland. They have good potential as habitat for wetland wildlife.

Because these soils are frequently flooded. they are not suited to cultivated crops. Flooding and frost action are the major hazards. Wetness and lack of adequate drainage outlets are major management problems.

If these soils are used for pasture, flooding is the major hazard. Grazing is restricted in wet periods.

If these soils are used for trees, windthrow hazard, flooding, equipment limitation, seedling mortality, and plant competition make their use impractical for commercial tree production. These soils are flooded or wet throughout much of the year, which results in trees blowing down during storms, heavy losses to plant seedlings, and restricted use of heavy equipment for planting and harvesting trees. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

These soils have severe limitations for most engineering uses. For local roads and streets to function properly, the surface layer of the Cohoctah and Ceresco soils should be covered with suitable base material. Capability subclass Vw, Michigan soil management group L-2c.

Cr—Corunna sandy loam. This is a nearly level, poorly drained and very poorly drained soil in broad, flat areas and drainageways. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 120 acres in size.

Typically, the surface layer is very dark gray sandy loam about 9 inches thick. The subsoil is gray, mottled, friable sandy loam about 22 inches thick. The substratum, to a depth of 60 inches, is gray, mottled, calcareous loam and clay loam. In some places, the surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of Parkhill, Belleville, and Lamson soils in broad, flat areas and drainageways. The Parkhill soil has a higher available water capacity, and the Belleville and Lamson soils have a lower available water capacity than this Corunna soil. Lamson and Belleville soils make up 1 to 13 percent of the mapped areas, and Parkhill soils make up 10 to 17 percent. Also included are small areas of somewhat poorly drained Capac and Metamora soils on low knolls and ridges; they make up 1 to 8 percent of the mapped areas.

Permeability is moderate or moderately rapid in the surface layer and subsoil and moderately slow in the substratum. The available water capacity is moderate. Runoff is very slow or ponded.

This soil is used mostly for crops. In a few areas, it is used for pasture or trees. This soil has good potential for crops, pasture, and as habitat for wetland wildlife. It has fair potential for woodland.

If this soil is used for cultivated crops, providing adequate drainage is the major management requirement. Artificial drainage can help increase crop yields.

If this soil is used for pasture, removing excess water is the major management requirement. Artificial drainage helps remove excessive water and thereby helps increase yields. Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, equipment limitation, seedling mortality, and plant competition are major management problems. Windthrow is the major hazard resulting in trees that blow down during storms. The use of heavy equipment for planting and harvesting trees is limited to periods when the soil is dry or frozen. Seedling losses are high because of wetness. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses because of wetness. For such uses, it must be artificially drained by using surface ditches and tile drains. Sanitary facilities should be connected to commercial sewers and treatment facilities. Footings and foundations should be designed to prevent structural damage caused by frost action. For local roads and streets to function properly, the surface layer of the Corunna soil should be replaced or covered with suitable base material. Capability subclass IIw, Michigan soil management group 3/2c.

DxA—Dixboro fine sandy loam, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges. It is subject to rare flooding. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 200 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsurface layer is pale brown fine sandy loam about 6 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is stratified, mottled, yellowish brown loam and pale brown, friable fine sandy loam. The lower part is light yellowish brown, mottled, friable loam with thin strata of loamy very fine sand and very fine sandy loam. The substratum, to a depth of 60 inches, is pale brown, mottled, calcareous, stratified fine sandy loam, loamy fine sand, and silt loam. In some places, the surface layer contains some pebbles or is lighter colored. Also in some places, the subsoil contains layers of gravelly sand or thicker layers of fine textured materials.

Included with this soil in mapping are small areas of the Metamora, Selfridge, Tedrow and Riverdale soils on low knolls and ridges. These soils make up 5 to 12 percent of the mapped areas. The Selfridge, Tedrow, and Riverdale soils have a lower available water capacity, and the Metamora soil has a higher available water capacity in the lower part of the profile than the Dixboro soils. Also included are small areas of poorly drained and very poorly drained Lamson and Parkhill soils in depressions and drainageways; they make up 1 to 9 percent of the mapped areas. Small areas of well drained Arkport soils on knolls and ridges and at a higher elevation than the Dixboro soil are also included. They make up 3 to 10 percent of the mapped areas.

Permeability is moderate to moderately rapid, and the available water capacity is high. Runoff is slow.

This soil is used mostly for crops. In a few areas, it is in permanent vegetation, including trees. This soil has good potential for crops, pasture, woodland, and as habitat for openland and woodland wildlife.

If this soil is used for cultivated crops, removing excess water is the major management requirement. Artificial drainage can help increase crop yields.

If this soil is used for pasture, wetness in spring is the major problem. Grazing is restricted in wet periods.

If this soil is used for trees, equipment limitations and plant competition are major management problems. The use of heavy equipment for planting and harvesting trees is restricted in wet periods in spring. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses, because of wetness, high potential frost action, and caving of cutbanks in shallow excavations. Using surface ditches and tile drains and connecting sanitary facilities to commercial sewers and treatment facilities overcome the limitation of wetness. Foundations and footings should be properly designed so that frost action does not cause structural damage. For local roads or streets to function properly, the surface layer of the Dixboro soil should be replaced or covered with a suitable base material. Constructing retaining walls, maintaining the proper slope grade, and removing excess water prevent the caving of cutbanks. The well drained Arkport soil is in slightly higher places and is better suited to most engineering uses. Capability subclass IIw, Michigan soil management group 3b-s.

Ed—Edwards muck. This is a nearly level, very poorly drained soil on lowlands. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 50 acres in size.

Typically, the upper 6 inches is black muck. Next, to a depth of 35 inches, is very dark brown and black, friable muck. Below that, the substratum, to a depth of 60 inches, is white and gray marl. In some places, mineral material underlies the muck at depths below 24 inches, or the thickness of the organic materials is more than 51 inches.

Included with this soil in mapping are small areas of Palms soils on lowlands; they make up 2 to 13 percent of the mapped areas. They have higher permeability in the underlying material than the Edwards soil.

Permeability is moderately slow to moderately rapid in the organic material, and it varies in the marl. The available water capacity is very high. Runoff is very slow.

This soil is mostly in native vegetation, including trees. In a few areas, it is used for unimproved pasture or crops. This soil has fair potential for crops. It has good potential for pasture and as habitat for wetland wildlife, and poor potential for woodland.

If this soil is properly drained and protected from soil blowing, it is suited to specialty crops, for example, potatoes, carrots, onions, and mint. Soil blowing, frost action, and flooding are the main hazards. Soil blowing and frost hazard can be reduced by sprinkler irrigation. Soil blowing can also be reduced by controlling the water table, by stripcropping, and by using cover crops and windbreaks. Flooding can be reduced by lowering the water table through artificial drainage or by constructing dikes. Lift pumps must be installed in areas that lack adequate drainage outlets.

If this soil is used for pasture, wetness is the major limitation. Artificial drainage and the selection of pasture plants that are tolerant of wetness help overcome this problem.

Equipment limitations, seedling mortality, plant competition flooding, and windthrow hazard are woodland management problems. Because this soil is wet, the use of heavy equipment for planting and harvesting trees is restricted. Seedling losses are high, and trees may blow down during storms.

This soil has severe limitations for most engineering uses, because of wetness, frost action, and excess humus. Capability subclass IVw, Michigan soil management group M/mc.

Gd—Gilford sandy loam, gravelly substratum. This is a nearly level, very poorly drained soil in broad, flat areas and drainageways. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 150 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 11 inches thick. The subsoil is friable, and it is about 18 inches thick. The upper part of the subsoil is dark gray, mottled sandy loam, and the lower part is gray, mottled sandy loam. The substratum, to a depth of 60 inches, is gray, calcareous coarse sand and gravelly sand. In some areas, the surface layer is thinner, or the subsoil contains alternate layers of sand, loamy sand, and sandy loam.

Included with this soil in mapping are small areas of Kingsville, Vestaburg, and Thomas soils in broad, flat areas and drainageways. These soils make up 1 to 10 percent of the mapped areas. The Kingsville and Vestaburg soils have a lower available water capacity in the upper part of the profile and the Thomas soil has a higher available water capacity than this Gilford soil.

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

This soil is used mostly for crops, or it is in native vegetation, including trees. It has fair potential for crops, and poor potential for woodland. It has good potential as habitat for wetland wildlife and for pasture.

If this soil is used for cultivated crops, providing adequate drainage and conserving soil moisture in dry periods are major management requirements. Artificial drainage can help increase crop yields. Crop residue, stubble mulching, cover crops, and minimum tillage help conserve moisture.

If this soil is used for pasture, wetness is the major problem. Grazing is restricted in wet periods. Artificial drainage can help remove excess water and thereby increase yields. Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, equipment limitations, seedling mortality, and plant competition are major management problems. The use of equipment for planting and harvesting trees is severely limited. Seedling losses are high because of wetness. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses, because of wetness and potential frost action. Surface ditches and tile drains will reduce wetness. Foundations and footings should be properly designed so that frost action does not cause structural damage. For local roads or streets to function properly, the surface layer of the Gilford soil should be replaced or covered with suitable base material. Capability subclass IIIw, Michigan soil management group 4c.

Ho—Houghton muck. This is a nearly level, very poorly drained soil on lowlands or flood plains. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 1,500 acres in size.

Typically, the upper 12 inches is black muck. Below that, to a depth of 60 inches, is very dark brown and brown muck. In a few places, mostly on the Maple River flood plain, the surface layer is mucky silt loam or silt. In some places, marl is at a depth of 16 to 51 inches.

Included with this soil in mapping are small areas of Adrian and Palms soils that generally are in narrow, discontinuous areas along the edges of mapped areas of this unit, and they make up 2 to 15 percent of the mapped areas. The Adrian soil has a lower available water capacity, and the Palms soil has slower permeability in the lower part of the profile than the Houghton soil. Also included, in some places, is a soil similar to this Houghton soil, except it is mucky peat and makes up 0 to 15 percent of the mapped areas. Also included, in Sumner and Seville Townships, are a few small areas, less than 100 acres, of a soil similar to this Houghton soil, except it is mucky peat and is extremely acid.

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

This soil is mostly in native vegetation, including trees. In a few areas, it is used for unimproved pasture or crops. This soil has fair potential for crops, good potential for pasture and as habitat for wetland wildlife, and poor potential for woodland.

If this soil is properly drained and protected from soil blowing, it is suited to specialty crops, for example, potatoes, carrots, onions, and mint. Soil blowing, frost action, and flooding are the main hazards. Soil blowing and frost action can be reduced by sprinkler irrigation. Soil blowing can also be reduced by controlling the water table and by using buffer strips, cover crops, and windbreaks. Flooding can be reduced by lowering the water table through artificial drainage or by constructing dikes. Lift pumps must be installed in areas that lack adequate drainage outlets.

If this soil is used for pasture, wetness is the major limitation. Grazing is restricted in wet periods. Artificial drainage and the selection of pasture plants that are tolerant of wetness help overcome this problem.

If this soil is used for trees, equipment limitations, seedling mortality, plant competition, and windthrow hazard are major management problems because this soil is wet. Equipment limitations can be reduced if the soil is worked when it is frozen. Sites must be intensively prepared and maintained because the growth of undesirable shrubs and trees hinders natural regeneration or restocking of desirable trees. Seedling losses are high, and trees may blow down during storms.

This soil has severe limitations for most engineering uses, because of wetness, frost action, and excess humus. The areas with more than 10 inches of mucky peat, which were included in mapping, are better suited to roads than this soil. Capability subclass IIIw, Michigan soil management group Mc.

HuB—Huntington silt loam, 1 to 5 percent slopes. This is a nearly level and gently sloping, well drained soil on a part of the flood plain that is protected from flooding. Slopes are slightly convex and are less than 30 feet long. The areas are irregular in shape and are 2 to 90 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 11 inches thick. The subsoil is friable, and it is about 44 inches thick. The upper part of the subsoil is dark brown silt loam, the middle part is brown silt loam, and the lower part is brown, mottled silt loam. The substratum, to a depth of 60 inches is brown, mottled fine sandy loam that has thin strata of silt loam.

Included with this soil in mapping are small areas of very poorly drained Sloan soils and a soil similar to this Huntington soil, except it is somewhat poorly drained and makes up 2 to 8 percent of the mapped areas. Also included are small areas where slopes are 6 to 10 percent.

Permeability is moderate, and the available water capacity is high. Runoff is slow or medium.

This soil is used mostly for crops. In a few areas it is wooded. Most areas of this soil are protected from flooding and therefore have good potential for crops, pasture, and woodland.

If this soil is used for cultivated crops, erosion is the major hazard. Controlling erosion and maintaining high organic-matter content, and good tilth are management requirements. The use of crop rotations with hay, cover crops, and minimum tillage help control erosion. Incorporating crop residue or green manure into the plow layer and tilling within the proper moisture range help maintain organic-matter content and improve tilth.

If this soil is used for pasture, overgrazing and grazing when this soil is wet are major management problems. Grazing this soil when it is wet causes compaction of the surface layer. Overgrazing increases the hazard of erosion. Using well adapted plants, rotating pasture, and restricting grazing in wet periods are important practices.

If this soil is used for trees, productivity is high; however, plant competition is a problem. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has slight limitations for most engineering uses, because it is protected from flooding. It has moderate potential frost action. Foundations and footings should be designed so that frost action does not cause structural damage. For local roads or streets to function properly, the surface layer of the Huntington soil should be replaced or covered with suitable base material. Capability subclass IIe, Michigan soil management group L-2a.

ItA—Ithaca loam, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges. It is subject to rare flooding. Slopes are slightly convex and are less than 100 feet long. The areas are irregular in shape and are 2 to 200 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 20 inches thick. The upper part of the subsoil is mixed, friable, brown clay loam and grayish brown loam 4 inches thick. The lower part is brown, mottled, very firm clay loam 16 inches thick. The substratum, to a depth of 60 inches, is brown, mottled, calcareous clay loam. In some places adjacent to the Pine River in the Alma area, this soil is underlain by stratified silt and very fine sand at a depth of 40 to 60 inches. Also in some places, the subsoil has a higher clay content, and in some places, many pebbles are scattered on the surface. The subsoil is thinner, and the depth to the calcareous substratum is less than 24 inches in some places.

Included with this soil in mapping are small areas of Arkona soils and a soil similar to this Ithaca soil, except it is sandy loam in the upper part of the profile. These soils are on low knolls and ridges; they make up 1 to 10 percent of the mapped areas. They have a lower available water capacity than this Ithaca soil. Also included are small areas of poorly drained and very poorly drained Lenawee and Wauseon soils in small depressions and narrow drainageways; they make up 1 to 8 percent of the mapped areas. Small, moderately well drained areas of the Perrinton soil that has slightly steeper slopes are also included.

Permeability is moderately slow, and the available water capacity is high. Runoff is slow or medium.

This soil is used mostly for crops. In a few areas, it is used for unimproved pasture or is in native vegetation, including trees. This soil has good potential for crops, pasture, woodland, and as habitat for openland and woodland wildlife.

If this soil is used for cultivated crops, removing excess water and maintaining good tilth are major management requirements. Artificial drainage can be used to remove excess water. Tilling within a proper range of moisture content, minimum tillage, and incorporating crop residue into the plow layer help maintain good tilth.

If this soil is used for pasture, removing excess water and maintaining good soil structure and tilth are major management requirements. Restricted grazing in wet periods reduces compaction of the surface layer and maintains soil structure and tilth. Artificial drainage can be used to remove excess water.

If this soil is used for trees, plant competition is a problem. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches or tile drains. Footings and foundations should be designed to prevent structural damage caused by frost action. For local roads and streets to function properly, the surface layer of the Ithaca soil should be replaced or covered with suitable base material. Perrinton soil is better suited to most engineering uses, because it is better drained. Capability subclass IIw, Michigan soil management group 1-5b.

Ke—Kingsville loamy sand. This is a nearly level, poorly drained and very poorly drained soil in broad, flat areas and drainageways. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 150 acres in size.

Typically, the surface layer is black loamy sand about 6 inches thick. The substratum, to a depth of 60 inches, is dark gray and gray sand. In some places, this soil is underlain by loamy or clayey material below 40 inches. Also, in some places the substratum contains thin strata of loamy sand and sandy loam.

Included with this soil in mapping are small areas of Belleville and Gilford soils that are in broad, flat areas and drainageways. These soils make up 1 to 8 percent of the mapped areas. The Belleville soil has a higher available water capacity in the lower part of the profile and the Gilford soil has a higher available water capacity in the upper part of the profile than this Kingsville soil. Also included are small areas of somewhat poorly drained Tedrow and Riverdale soils on low knolls and ridges; they make up 1 to 5 percent of the mapped areas.

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

This soil is mostly in permanent vegetation, including trees. In a few areas, it is used for crops or pasture. This soil has good potential for pasture. It has fair potential for crops and as habitat for wetland wildlife. It has poor potential for woodland.

If this soil is used for cultivated crops, removing excess water in wet periods, conserving moisture in dry periods, controlling soil blowing, and maintaining high organic-matter content are major management requirements. Artificial drainage must be installed to remove excess water. Open ditches are difficult to maintain and tile is difficult to install, because cutbanks cave in. Minimum tillage, stubble mulching, and the use of cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, excess water in wet periods and droughtiness in dry summers are major management problems. Artificial drainage can be used to remove excess water. Grazing is restricted in wet periods and growth is reduced in dry periods.

If this soil is used for trees, windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are also major problems. Because of wetness, seedling losses are high, and trees may blow down during storms. The use of equipment for planting and harvesting trees is restricted in wet periods. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches and tile drains. For local roads and streets to function properly, the surface layer of the Kingsville soil should be covered with suitable base material. Removing excess water, constructing retaining walls, and maintaining the proper slope grade can prevent caving of cutbanks in shallow excavations. Capability subclass IVw, Michigan soil management group 5c.

La—Lamson loamy very fine sand. This is a nearly level, poorly drained and very poorly drained soil in broad, flat areas and drainageways. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 50 acres in size.

Typically, the surface layer is very dark gray loamy very fine sand about 9 inches thick. The subsoil is very friable, mottled loamy very fine sand about 26 inches thick. The upper part of the subsoil is very dark gray, and the lower part is light olive brown. The substratum, to a depth of 60 inches, is grayish brown and gray, calcareous very fine sand. In some areas, the surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of somewhat poorly drained Dixboro soils on low knolls and ridges; they make up 1 to 8 percent of the mapped areas. Also included are small areas of Thomas, Tobico, Corunna, and Parkhill soils in broad, flat areas and drainageways. These soils make up 1 to 8 percent of the mapped areas. The Thomas, Corunna, and Parkhill soils have a higher available water capacity and the Tobico soil has a lower available water capacity than this Lamson soil.

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

This soil is mostly used for crops. In a few areas, it is in native vegetation, including trees. This soil has good potential for pasture and as habitat for wetland wildlife. It has fair potential for crops and poor potential for woodland.

If this soil is used for cultivated crops, removing excess water is the major management requirement. Artificial drainage can help increase crop yields.

If this soil is used for pasture, removing excess water is the major management requirement. Grazing is restricted in wet periods. Artificial drainage can be used to remove excess water, and thereby increase yields.

Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are major management problems. Seedling losses are high, and trees may blow down during storms, because this soil is wet. The use of heavy equipment for planting and harvesting trees is restricted. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses because of wetness, frost action, and seepage. For such uses, it must be artificially drained by using surface ditches or tile drains. Dwellings and small buildings with basements should not be constructed on this soil. Footings and foundations should be designed to prevent structural damage caused by frost action. For local roads and streets to function properly, the surface layer of the Lamson soil should be replaced or covered with suitable base material. Capability subclass IIIw, Michigan soil management group 3c-s.

Le—Lenawee clay loam. This is a nearly level, poorly drained and very poorly drained soil in broad, flat areas and drainageways. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 1,500 acres in size.

Typically, the surface layer is very dark grayish brown clay loam about 9 inches thick. The subsoil is about 28 inches thick. The upper part of the subsoil is dark gray, firm clay loam 9 inches thick, and the lower part is gray, mottled, very firm clay loam 19 inches thick. The substratum, to a depth of 60 inches, is gray, mottled, calcareous clay loam and clay. In some places, the surface layer is lighter colored. These soils lack stratification in some areas.

Included with this soil in mapping are small areas of Sickles and Wauseon soils in broad, flat areas and drainageways; they make up 5 to 10 percent of the mapped areas. The Sickles and Wauseon soils have a lower available water capacity in the upper part of the profile than this Lenawee soil. Also included are small areas of somewhat poorly drained Pert, Ithaca, and Arkona soils on low knolls and ridges. These soils make up 1 to 8 percent of the mapped areas.

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

This soil is used mostly for crops. In a few areas, it is used for pasture or it is in native vegetation, including trees. This soil has good potential for crops, pasture, and woodland and as habitat for wetland wildlife.

If this soil is used for cultivated crops, removing excess water and maintaining good tilth are major management requirements. Artificial drainage can be used to remove excess water. Tilling within the proper range of moisture content, minimum tillage, and incorporating crop residue into the plow layer help maintain good tilth.

If this soil is used for pasture, removing excess water and maintaining good structure and tilth are major management requirements. Restricted grazing in wet periods helps prevent soil compaction and maintain structure and tilth.

If this soil is used for trees, equipment limitations, seedling mortality, and plant competition are major management problems. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. Seedling losses are high, because of excess water. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches or tile drains. Dwellings and small buildings with basements should not be constructed on this soil. Footings and foundations should be designed to prevent structural damage caused by frost action and shrink-swell potential. For local roads and streets to function properly, the surface layer of the Lenawee soil should be replaced or covered with suitable base material. Capability subclass IIw, Michigan soil management group 1.5c.

MaB—Marlette sandy loam, 2 to 6 percent slopes. This is a gently sloping, well drained and moderately well drained soil on footslopes, knolls, and ridges. Most areas are dissected by shallow drainageways. Slopes are smooth and convex and are less than 100 feet long. The areas are irregular in shape and are 2 to 500 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 10 inches thick. The subsurface layer is pale brown sandy loam about 4 inches thick. The subsoil is friable, and it is about 20 inches thick. The upper part of the subsoil is mixed, yellowish brown loam and pale brown sandy loam, the middle part is brown clay loam, and the lower part is strong brown loam. The substratum, to a depth of 60 inches, is brown, mottled, calcareous loam. In some places, slopes are less than 2 percent or they exceed 6 percent. Also, in some places the upper part of the subsoil is sandy loam. In some places, there is no intermixing of the subsurface material in the upper part of the subsoil.

Included with this soil in mapping are small areas of Metea, Arkport, Spinks, and Boyer soils that are on foot slopes, knolls, and ridges. These soils make up 0 to 10 percent of the mapped areas. They have a lower available water capacity than this Marlette soil. Also included are somewhat poorly drained Capac and Metamora soils on low knolls and ridges at a lower elevation than this Marlette soil; they make up 2 to 11 percent of the mapped areas. Also included are poorly drained and very poorly drained Parkhill, Thomas, and Palms soils in small depressions or narrow drainageways; they make up 0 to 6 percent of the mapped areas.

Permeability is moderate or moderately slow, and the available water capacity is high. Runoff is medium.

This soil is used mostly for crops. In a few areas, it is used for pasture or it is in permanent vegetation, including trees. This soil has good potential for crops, pasture, woodland, and recreational use, and as habitat for openland and woodland wildlife.

If this soil is used for cultivated crops, controlling runoff and erosion and maintaining high organic-matter content and good tilth are major management requirements. The use of crop rotation with hay, cover crops, sod waterways, and minimum tillage help reduce erosion. In a few areas, the slopes are sufficiently long and smooth for terracing and contour farming. Incorporating crop residue or green manure into the plow layer and tilling within the proper moisture range help maintain organic-matter content and improve tilth.

If this soil is used for pasture, overgrazing and grazing this soil when it is wet are major management problems. Grazing this soil when it is wet causes compaction of the surface layer. Overgrazing increases the hazard of erosion. Using well adapted pasture plants, rotating pasture, and restricting grazing in wet periods are important practices.

If this soil is used for trees, plant competition is a major problem. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has slight or moderate limitations for engineering uses. When this soil is used for septic tank absorption fields, the moderate and moderately slow permeability is a moderate limitation. When this soil is used for sewage lagoons, seepage is also a moderate limitation. Using a sealer or restrictive layer of impervious material will reduce seepage. Small commercial buildings and dwellings with basements should not be constructed on this soil because of frost action. Foundations and footings should be designed so that frost action does not cause structural damage. For local roads or streets to function properly, the surface layer of the Marlette soil should be replaced or covered with suitable base material. This soil can erode easily especially when the surface layer is left uncovered during or after construction. Mulching, using an asphalt spray, netting, grass seeding or sodding with fertilization, diversions, erosion-control structures, and grassed waterways help control erosion. Capability subclass IIe, Michigan soil management group 2.5a.

MaC—Marlette sandy loam, 6 to 12 percent slopes. This is a moderately sloping or gently rolling, well drained soil on knolls and ridgetops. Most areas are dissected by shallow drainageways. Slopes are smooth and convex and are less than 200 feet long. The areas are irregular in shape and are 2 to 100 acres in size.

Typically, the surface layer is brown sandy loam about 9 inches thick. The subsurface layer is pale brown sandy loam about 3 inches thick. The subsoil is friable, and it is about 17 inches thick. The upper part is mixed, yellowish brown and pale brown loam; and the lower part is brown clay loam. The substratum, to a depth of 60 inches, is brown calcareous loam. In some places, most of the original surface layer has been eroded, and the present surface layer is a mixture of material from the remaining original surface layer, the subsurface layer, and the upper part of the subsoil. In some places, the upper part of the subsoil is sandy loam. Also, some areas are less sloping or more sloping.

Included with this soil in mapping are small areas of Metea, Spinks, and Boyer soils on knolls and ridgetops, or on footslopes. These soils make up 0 to 8 percent of the mapped areas. They have a lower available water capacity than this Marlette soil. Also included are somewhat poorly drained Capac and Metamora soils on foot slopes, low knolls, and ridges at a lower elevation than this Marlette soil; they make up 1 to 8 percent of the mapped areas. Also included are poorly drained and very poorly drained Parkhill and Palms soils in depressions and drainageways; they make up 0 to 10 percent of the mapped areas.

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

This soil is used mostly for crops or pasture. In a few areas, it is in permanent vegetation, including trees. This soil has fair potential for crops and recreational use. It has good potential for pasture, and woodland and as habitat for openland and woodland wildlife.

If this soil is used for cultivated crops, controlling runoff and erosion and maintaining high organic-matter content and good tilth are major management requirements. The use of crop rotation with hay, cover crops, sod waterways, and minimum tillage help reduce erosion. In a few areas, the slopes are sufficiently long and smooth for terracing and contour farming. Incorporating crop residue or green manure into the plow layer and tilling within the proper moisture range help maintain organic-matter content and improve tilth.

If this soil is used for pasture, overgrazing and grazing this soil when it is wet are major management problems. Grazing this soil when it is wet causes compaction of the surface layer. Overgrazing increases the hazard of erosion. Using well adapted pasture plants, rotating pasture, and restricting grazing in wet periods are important practices.

If this soil is used for trees, plant competition is the major management problem. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has moderate limitations for most engineering uses because of slope and potential frost action. For such uses, foundations and footings should be designed to prevent structural damage caused by frost action. For local roads and streets to function properly, the surface layer of the Marlette soil should be replaced or covered with suitable base material. Construction sites and local roads and streets need landforming and should be on the contour. This sloping Marlette soil erodes easily when the surface layer is left uncovered during or after construction. Mulching, using an asphalt spray, netting, grass seeding or sodding with fertilization, diversion, erosion-control structures, or grassed waterways help control erosion and reduce runoff. Capability subclass IIIe, Michigan soil management group 2.5a.

Mc—Martisco muck. This is a nearly level, very poorly drained soil on lowlands. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 50 acres in size.

Typically, the upper 12 inches is black muck. Below that, the substratum, to a depth of 60 inches, is light gray and gray marl. In some places, mineral material underlies the marl below 24 inches or the organic layer is less than 8 inches thick.

Included with this soil in mapping are small areas of Edwards, Tobico, and Thomas soils on lowlands. These soils make up 5 to 12 percent of the mapped areas. The Edwards and Thomas soils have a higher available water capacity and the Tobico soil has a lower available water capacity than this Martisco soil.

Permeability is moderately slow to moderately rapid in the organic material and slow in the marl. The available water capacity is low. Runoff is very slow.

This soil is used mostly for unimproved pasture or it is in native vegetation, including trees. This soil has good potential as habitat for wetland wildlife and poor potential for crops, pasture, and woodland.

If this soil is used for pasture, wetness and flooding are major problems. Grazing is restricted for long periods because of wetness unless artificial drainage is provided.

If this soil is used for trees, wetness and flooding are major problems. Windthrow hazard, seedling mortality, equipment limitations, and plant competition are severe problems. Because of wetness and flooding, the use of heavy equipment for planting and harvesting trees is restricted, seedling losses are high, and trees may blow down during storms. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses because of wetness, frost action, and excess humus. Capability subclass VIw, Michigan soil management group M/mc.

MeA—Metamora-Capac sandy loams, 0 to 2 percent slopes. This map unit is about 45 to 60 percent Metamora soils and 20 to 40 percent Capac soils. These soils are nearly level and somewhat poorly drained and are on low knolls and ridges. They are subject to rare flooding. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 200 acres in size. The soils are so intricately mixed, or so small in extent, that it is not practical to map them separately.

Typically, the surface layer of the Metamora soil is very dark grayish brown sandy loam about 9 inches thick. The subsoil is grayish brown, mottled, and friable, and is about 28 inches thick. The upper part of the subsoil is sandy loam 24 inches thick, and the lower part is sandy clay loam 4 inches thick. The substratum, to a depth of 60 inches, is brown, mottled, calcareous loam.

Typically, the surface layer of the Capac soil is very dark grayish brown sandy loam about 8 inches thick. The subsoil is mottled, firm clay loam, and it is about 20 inches thick. The upper part of the subsoil is yellowish brown, the middle part is light yellowish brown, and the lower part is brown. The substratum, to a depth of 60 inches, is grayish brown, mottled, calcareous loam. In some places, the subsoil is less than 20 inches thick, and the depth to the calcareous substratum is less than 26 inches.

Included with these soils in mapping are small areas of Dixboro and Selfridge soils on low knolls and ridges; they make up 0 to 12 percent of the mapped areas of this unit. The Dixboro soil has a lower available water capacity than the Metamora and Capac soils, and the Selfridge soil has a lower available water capacity in the lower part of the profile. Also included are small areas of Lamson, Parkhill, and Corunna soils in depressions and drainageways; they make up 0 to 8 percent of the mapped areas of this unit.

Permeability in the Metamora soil is moderately rapid in the surface layer and subsoil and moderately slow in the substratum. Permeability in the Capac soil is moderate and moderately slow. The available water capacity for Metamora and Capac soils is high. Runoff is slow.

These soils are used mostly for crops. In a few areas, they are used for pasture or are in native vegetation, including trees. These soils have good potential for crops, pasture, and woodland and as habitat for openland and woodland wildlife.

If these soils are used for cultivated crops, removing excess water is the major management requirement. Artificial drainage can help increase crop yields.

If these soils are used for pasture, removing excess water is the major management requirement. Artificial drainage will help increase yields. Restricted grazing in wet periods helps reduce compaction of the surface layer.

If these soils are used for trees, equipment limitations and plant competition are major management problems. The use of heavy equipment for planting and harvesting trees is restricted in wet periods in spring. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

These soils have severe limitations for most engineering uses. For such uses, they must be artificially drained by using surface ditches or tile drains. Footings and foundations should be designed to prevent structural damage caused by frost action. For local roads and streets to function properly, the surface layer of the Metamora and Capac soils should be replaced or covered with suitable base material. Capability subclass IIw, Michigan management group 3/2b-2.5b.

MtB—Metea loamy sand, 0 to 6 percent slopes. This is a nearly level and gently sloping, well drained soil on knolls and ridges. Slopes are smooth and convex and are less than 100 feet long. The areas are irregular in shape and are 2 to 80 acres in size.

Typically, the surface layer is dark brown loamy sand about 6 inches thick. The subsoil is yellowish brown about 33 inches thick. The upper part of the subsoil is very friable loamy sand 27 inches thick, and the lower part is mottled, firm clay loam 6 inches thick. The substratum, to a depth of 60 inches, is yellowish brown loam. In some places, slopes are steeper than 6 percent. In some areas, especially near the Perrinton soil, the substratum has a higher clay content than this Metea soil.

Included with this soil in mapping are small areas of Arkport, Perrinton, Marlette, Oakville, and Boyer soils on knolls and ridges. Perrinton, Marlette, Oakville, and Boyer soils make up 1 to 10 percent of the mapped areas, and the Arkport soil makes up 3 to 16 percent. The Perrinton and Marlette soils have a higher available water capacity and the Boyer, Oakville, and Arkport soils have a lower available water capacity than this Metea soil. Also included is the somewhat poorly drained Selfridge soil on low knolls and ridges at a lower elevation than this Metea soil and the poorly drained and very poorly drained Belleville soil in depressions and drainageways. Metea and Belleville soils make up 0 to 5 percent of the mapped areas.

Permeability is very rapid in the sandy upper part of the profile and moderately slow to moderate in the loamy lower part. The available water capacity is moderate. Runoff is slow.

This soil is used mostly for crops or it is in permanent vegetation, including trees. In a few areas, it is used for pasture. This soil has fair potential for crops, recreational use and as habitat for woodland and openland wildlife. It has good potential for pasture and woodland.

If this soil is used for cultivated crops, soil blowing and droughtiness are major management problems. Controlling soil blowing, maintaining high organic-matter content, and conserving moisture are major management requirements. Minimum tillage and stubble mulching and the use of cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, droughtiness is the major limitation. The use of deep-rooted, drought-resistant plants will help reduce droughtiness.

If this soil is used for trees, seedling mortality is the major management problem. Some seedling losses can be expected because the sandy upper part of this Metea soil has a low available water capacity.

This soil has slight limitations for most engineering uses. Capability subclass IIIe, Michigan soil management group 4/2a.

MvB—Metea Variant cobbly loamy sand, 2 to 6 percent slopes. This is a gently sloping, well drained and moderately well drained soil on ridges. Slopes are smooth and convex and are less than 100 feet long. The areas are generally long and narrow and are 2 to 50 acres in size.

Typically, the surface layer is very dark gray cobbly loamy sand about 7 inches thick. The subsoil is about 30 inches thick. The upper part of the subsoil is dark brown and dark yellowish brown, very friable, cobbly loamy sand 24 inches thick. The lower part is yellowish brown, mottled, firm loam 6 inches thick. The substratum, to a depth of 60 inches, is brown, calcareous loam.

Included with this soil in mapping are small areas of Boyer soils on ridges, small areas of soils similar to the somewhat poorly drained Selfridge soil on lower ridges, and small areas of soils similar to the poorly drained and very poorly drained Belleville soil in small depressions and drainageways. These included soils have similar amounts of and depths to cobbles as the Metea Variant soil; they make up 5 to 12 percent of the mapped areas. The Boyer soil has a lower available water capacity in the lower part of the profile than this Metea Variant soil.

Permeability is rapid in the sandy upper part and moderate to moderately slow in the loamy lower part. The available water capacity is moderate. Runoff is slow.

This soil is mostly in permanent vegetation, including trees. In a few areas, it is used for crops or pasture. This soil has good potential for woodland and fair potential for pasture. It has poor potential for crops and as habitat for openland and woodland wildlife.

This soil generally is not used for cultivated crops, because of the presence of cobbles.

If this soil is used for pasture, removing cobbles and conserving moisture are major management requirements. Deep-rooted, drought-resistant plants should be selected.

If this soil is used for trees, seedling mortality is the major management problem. Some seedling losses can be expected, because the sandy upper part of this Metea Variant soil has a low available water capacity. Hand planting of seedlings may be necessary because of the cobbles in the surface layer.

This soil has moderate limitations for most engineering uses. For such uses, foundations and footings should be designed to prevent structural damage caused by shrink-swell potential. Cobbles also hinder most earth-moving operations. Capability subclass VIs, Michigan soil management group Ga.

OaB—Oakville fine sand, 0 to 6 percent slopes. This is a nearly level and gently sloping, well drained and moderately well drained soil on knolls and ridges. Slopes are smooth and convex and are less than 100 feet long. The areas are irregular in shape and are 2 to 50 acres in size.

Typically, the surface layer is very dark grayish brown fine sand about 6 inches thick. The subsoil is yellowish brown and brownish yellow, loose fine sand about 19 inches thick. The substratum, to a depth of 60 inches, is light yellowish brown fine sand.

Included with this soil in mapping are small areas of Boyer and Metea soils on knolls and ridges. These soils make up 1 to 8 percent of the mapped areas. They have a higher available water capacity in the subsoil than this Oakville soil. Also included is the somewhat poorly drained Tedrow soil on low knolls and ridges and the poorly drained and very poorly drained Kingsville soil in depressions and drainageways; they make up 1 to 10 percent of the mapped areas.

Permeability is very rapid, and the available water capacity is low. Runoff is very slow.

This soil is mostly in permanent vegetation, including trees. In a few areas, it is used for pasture and crops. This soil has good potential for pasture and woodland and poor potential for crops.

If this soil is used for cultivated crops, soil blowing and droughtiness are major management problems. Controlling soil blowing, maintaining high organic-matter content, and conserving moisture are major management requirements. Minimum tillage and stubble mulching and the use of cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, manure, and green manure help to maintain content or organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, droughtiness is the major hazard. The use of deep-rooted, drought-resistant plants will help overcome droughtiness.

If this soil is used for trees, seedling mortality is the major problem. Seedling losses are high, because of the low available water capacity.

This soil has slight limitations for use as dwellings, small commercial buildings, and local roads and streets. It has severe limitations for sewage lagoons, sanitary landfills, and shallow excavations, because the soil is too sandy, cutbanks cave, and seepage occurs. Lawns need a cover of loamy topsoil and should be watered frequently. Cleared areas around construction sites should be protected from soil blowing by mulching and using asphalt spray, netting, grass seeding or sodding with fertilization, planting clumps of grass, keeping cleared areas to a minimum size, or constructing windbreaks or snowfences. Constructing retaining walls and maintaining the proper slope grade can prevent caving of cutbanks in shallow excavations. Seepage from sewage lagoons and sanitary landfills can be prevented by using a sealer or restrictive layer of impervious material. Capability subclass IVs, Michigan soil management group 5a.

Oe—Olentangy muck. This is a nearly level, very poorly drained soil on lowlands. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 50 acres in size.

Typically, the upper 13 inches is black muck. The next layer is black, friable mucky silt loam 13 inches thick, and below that is dark gray, friable mucky silt loam 12 inches thick. The substratum, to a depth of 60 inches, is mottled, grayish brown silt loam. In some places, the muck layers are more than 16 inches thick. Also, in a few places, the depth to the mineral substratum is more than 51 inches.

Included with this soil in mapping are small areas of Thomas and Houghton soils; they make up 1 to 8 percent of the mapped areas. The Thomas soil is in narrow, discontinuous areas along the edges of mapped areas of this unit. The Thomas and Houghton soils have a higher available water capacity than this Olentangy soil.

Permeability is moderate in the upper organic and coprogenous materials and slow in the lower mineral materials. The available water capacity is very high. Runoff is very slow or ponded.

This soil is mostly in native vegetation, including trees. In a few areas, it is used for pasture. This soil has good potential as habitat for wetland wildlife. It has fair potential for crops and poor potential for pasture and woodland.

If this soil is properly drained and protected from soil blowing, it is suited to specialty crops, for example, potatoes, carrots, onions, and mint. Soil blowing, flooding, and frost action are major hazards. Soil blowing and frost damage can be reduced by sprinkler irrigation. Controlling the water table and using buffer strips, cover crops, and windbreaks can also reduce soil blowing. Lowering the water table through installation of artificial drainage can reduce flooding and wetness. Lift pumps must be installed in areas that lack adequate drainage outlets.

If this soil is used for pasture, wetness is the major limitation. Grazing is restricted in wet periods. Practices to overcome wetness are installing artificial drainage and selecting pasture plants that are tolerant of wetness.

Because this soil is wet, equipment limitations, seedling mortality, windthrow, and plant competition are major woodland management problems. The use of equipment for planting and harvesting trees is restricted in wet periods. Seedling losses are high, and trees may blow down during storms. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses, because of wetness, frost action, and excess humus. Capability subclass IIIw, Michigan soil management group M/3c.

Pa—Palms muck. This is a nearly level, very poorly drained soil on lowlands. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 300 acres in size.

Typically, black muck extends to a depth of 35 inches. Below that, the substratum, to a depth of 60 inches, is gray, mottled clay loam. In some places, the organic material is less than 16 inches thick.

Included with this soil in mapping are small areas of Adrian and Houghton soils; they make up 8 to 17 percent of the mapped areas. The Adrian soil has a lower available water capacity in the lower part of the profile and the Houghton soil has a higher available water capacity in the underlying material than the Palms soil.

Permeability is moderately slow to moderately rapid in the organic material and moderate or moderately slow in the underlying material. The available water capacity is very high. Runoff is very slow.

This soil is mostly in native vegetation, including trees. In a few areas, it is used for unimproved pasture or crops. This soil has good potential for crops, pasture, and as habitat for wetland wildlife. It has poor potential for woodland.

If this soil is properly drained and protected from soil blowing, it is suited to specialty crops, for example, potatoes, carrots, onions, and mint. Soil blowing, frost action, and flooding are major hazards. Soil blowing and frost action can be reduced by sprinkler irrigation (fig. 2). Controlling the water table and using buffer strips, cover crops, and windbreaks can also reduce soil blowing. Flooding can be reduced by lowering the water table through artificial drainage or by constructing dikes. Lift pumps must be installed in areas that lack adequate drainage outlets.

If this soil is used for pasture, the major limitation is wetness. Grazing is restricted in wet periods. Practices to overcome wetness are installing artificial drainage and selecting pasture plants that are tolerant of wetness.

Because this soil is wet, equipment limitations, seedling mortality, plant competition, and windthrow hazard are major woodland management problems. Equipment limitations can be reduced if the soil is worked when it is frozen. Sites must be intensively prepared and maintained because the growth of undesirable shrubs and trees hinders natural regeneration or restocking of desirable trees. Seedling losses are high, and trees may blow down during storms.

This soil has severe limitations for most engineering uses, because of wetness, frost action, and excess humus. Capability subclass IIw, Michigan soil management group M/3c.

Ph—Parkhill loam. This is a nearly level, poorly drained and very poorly drained soil in broad, flat areas and drainageways. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 2,500 acres or more in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is mottled and firm about 27 inches thick. The upper part of the subsoil is grayish brown clay loam 4 inches thick, and the lower part is gray clay loam 23 inches thick. The substratum, to a depth of 60 inches, is mottled, gray and yellowish brown, calcareous loam. In some places, the surface layer is lighter colored and ranges to 12 inches in thickness. Also, in some places the subsoil and substratum have thin layers of gravelly sand, sand, gravelly sandy loam, or sandy loam.

Included with this soil in mapping are small areas of Corunna, Belleville, Lamson, Gilford, and Vestaburg soils in broad, flat areas and drainageways. These soils make up 5 to 15 percent of the mapped areas. They have a lower available water capacity than the Parkhill soil. Also included are small areas of somewhat poorly drained Capac, Metamora, and Selfridge soils on low knolls and ridges; they make up 1 to 10 percent of the mapped areas.

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

This soil is used mostly for crops. In a few areas, it is in woodland. This soil has good potential for crops, pasture, woodland, and as habitat for wetland wildlife.

If this soil is used for cultivated crops, removing excess water and maintaining good tilth are major management requirements. Artificial drainage can help increase crop yields. Good tilth can be maintained by tilling within the proper range of moisture content, using minimum tillage, and incorporating crop residue into the plow layer.

If this soil is used for pasture, removing excess water is the major management requirement. Restricted grazing in wet periods reduces compaction of the surface layer. Artificial drainage can help to remove excess water, and thereby increase yields. Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, equipment limitations, seedling mortality, and plant competition are major management problems. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. Seedling losses are high, because of wetness. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches or tile drains. Footings and foundations should be designed to prevent structural damage caused by frost action. Dwellings and small buildings with basements should not be constructed on this soil. For local roads and streets to function properly, the surface layer of the Parkhill soil should be replaced or covered with suitable base material. Capability subclass IIw, Michigan soil management group 2.5c.

PkB—Perrinton loam, 2 to 6 percent slopes. This is a gently sloping, well drained and moderately well drained soil on foot slopes, knolls, and ridgetops. Most areas are dissected by shallow drainageways. Slopes are smooth and convex and are less than 100 feet long. The areas are irregular in shape and are 2 to 300 acres in size.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The upper part of the subsoil is mixed brown clay loam and grayish brown loam about 6 inches thick, and the lower part is yellowish brown, very firm clay and firm clay loam about 18 inches thick. The substratum, to a depth of 60 inches, is brown, calcareous clay loam. In some places, the surface layer is sandy loam or loamy sand. In some places, the slope exceeds 6 percent. In some places there is no layer of mixed clay loam and loam.

Included with this soil in mapping are small areas of Metea soils on foot slopes, knolls, and ridgetops. These soils have a lower available water capacity than the Perrinton soil. They make up 1 to 8 percent of the mapped areas. Also included are small areas of very gently sloping, somewhat poorly drained Ithaca soils at the base of slopes and poorly drained and very poorly drained Lenawee and Parkhill soils in depressions and drainageways. These soils make up 1 to 9 percent of the mapped areas.

Permeability is moderately slow, and the available water capacity is moderate. Runoff is medium.

This soil is used mostly for crops. In a few areas, it is used for pasture or woodland. This soil has good potential for crops, pasture, and woodland and as habitat for openland and woodland wildlife.

If this soil is used for cultivated crops, the hazard of erosion is moderate. Controlling runoff and erosion, maintaining high organic-matter content, and maintaining good tilth are the major management requirements. The use of cover crops, grassed waterways, and minimum tillage and rotating cultivated crops with hay reduce erosion. Slopes are sufficiently long and smooth in a few areas for terracing and contour farming.

Incorporating crop residue and green manure crops into the plow layer and tilling within the proper range of moisture content help maintain organic-matter content and improve tilth.

Overgrazing and grazing when this soil is wet are the major management problems if this soil is used for pasture. Grazing when this soil is wet causes compaction of the surface layer, and overgrazing increases the hazard of erosion. Using well adapted pasture plants, rotating pasture, and restricting grazing in wet periods are important practices.

If this soil is used for trees, plant competition is a problem. The sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has moderate limitations for most engineering uses because of moderately slow permeability, shrink-swell potential, and frost action. For such uses, footings and foundations should be designed so that frost action and shrink-swell potential do not cause structural damage. Drainage should be provided around foundations, and excavations for drainage should be backfilled with suitable material. For local roads and streets to function properly, the surface layer should be replaced or covered with suitable base material. This soil erodes readily if the surface is not protected during and after construction. Practices that help control erosion include mulching, spraying with asphalt, and use of netting. Seeding with grass or establishing sod, properly fertilized, and the use of diversions, erosion-control structures; and grassed waterways are also effective practices. Capability subclass IIe, Michigan soil management group 1.5a.

PkC—Perrinton loam, 6 to 12 percent slopes. This is a moderately sloping and gently rolling, well drained soil on knolls and ridgetops. Most areas are dissected by shallow drainageways. Slopes are smooth and convex and are less than 200 feet long. The areas are irregular in shape and are 2 to 240 acres in size.

Typically, the surface layer is brown loam about 8 inches thick. The upper part of the subsoil is mixed grayish brown loam and brown clay loam about 6 inches thick and the lower part is yellowish brown, very firm clay and firm clay loam about 16 inches thick. The substratum, to a depth of 60 inches, is brown, calcareous clay loam. In some places, there is no layer of mixed clay loam and loam, the subsoil is exposed because of erosion, or the slope is less than 6 percent or greater than 12 percent.

Included with this soil in mapping are small areas of Metea soils on foot slopes, knolls, and ridgetops. These soils make up 1 to 8 percent of the mapped areas. The Metea soils have a lower available water capacity than this Perrinton soil. Also included are small areas of gently sloping, somewhat poorly drained Ithaca soils at the base of slopes and in narrow drainageways and depressions. These soils make up 2 to 12 percent of the mapped areas. Also included are small areas of poorly drained and very poorly drained Lenawee, Houghton, and Palms soils in depressions, seep areas at the base of hills, and narrow drainageways. These soils make up 1 to 8 percent of the mapped areas.

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

This soil is used mostly for crops and pasture. In a few areas, it is wooded. This soil has fair potential for crops and good potential for pasture and woodland. It also has good potential as habitat for openland and wetland wildlife.

If this soil is used for cultivated crops, the hazard of erosion is severe. Controlling runoff and erosion, maintaining high organic-matter content, and maintaining good tilth are the major management requirements. The use of cover crops, grassed waterways, and minimum tillage and rotating cultivated crops with hay help reduce erosion. In a few areas, the slopes are sufficiently long and smooth for terracing and contour farming. Incorporating crop residue and green manure crops into the plow layer and tilling within the proper moisture range are practices that help maintain organic-matter content and improve soil tilth. Large amounts of manure help improve tilth and structure and are especially beneficial in small, eroded areas.

If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major management problems. Grazing this soil when wet causes compaction of the surface layer, and overgrazing increases the hazard of erosion. The use of well adapted pasture plants, rotating pasture, and restricting grazing in wet periods are important practices.

If this soil is used for trees, plant competition is a problem. The sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has moderate limitations for most engineering uses because of slope, moderately slow permeability, shrink-swell potential, and frost action. For such uses, footings and foundations should be designed so that frost action and shrink-swell potential do not cause structural damage. Drainage should be provided around foundations, and excavations for drainage should be backfilled with suitable material. For local roads and streets to function properly, the surface layer should be covered or replaced with suitable base material. Construction sites and local roads and streets need landforming and should be on the contour. This soil erodes readily if the surface is not protected during and after construction. Practices that help control erosion and reduce runoff are the use of mulch, asphalt spray, and netting; seeding with grass or establishing sod that is properly fertilized; and constructing diversions, erosion-control structures, and grassed waterways. Capability subclass IIIe, Michigan soil management group 1.5a.

PlA—Pert clay loam, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and narrow ridges. It is subject to rare flooding. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 150 acres in size.

Typically, the surface layer is dark grayish brown clay loam about 9 inches thick. The subsoil is mottled and very firm, and it is about 10 inches thick. The upper part of the subsoil is brown clay, and the lower part is brown clay loam. The substratum, to a depth of 60 inches, is grayish brown, mottled, calcareous clay loam.

Included with this soil in mapping are small areas of Arkona and Metamora soils on low knolls and ridges; they make up 1 to 8 percent of the mapped areas. The Arkona and Metamora soils have a lower available water capacity than the Pert soil. Also included are small areas of poorly drained and very poorly drained Lenawee, Toledo, and Wauseon soils in depressions and drainageways; they make up 0 to 5 percent of the mapped areas.

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

This soil is used mostly for crops. In a few areas, it is in permanent vegetation, including trees. This soil has fair potential for crops. It has good potential for pasture and woodland, and as habitat for openland and woodland wildlife.

If this soil is used for cultivated crops, removing excess water and maintaining good tilth are major management requirements. Artificial drainage can be used to remove excess water. Tilling within the proper range of moisture content, using minimum tillage, and incorporating crop residue into the plow layer help maintain good tilth.

If this soil is used for pasture, removing excess water and maintaining good structure and tilth are major management requirements. Restricted grazing in wet periods reduces compaction of the surface layer and maintains soil structure and tilth. Artificial drainage can be used to remove excess water.

If this soil is used for trees, equipment limitations and plant competition are major management problems. The use of heavy equipment for planting and harvesting trees is restricted in wet periods in spring. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches and tile drains. Dwellings and small buildings with basements should not be constructed on this soil. Footings and foundations should be designed to prevent structural damage caused by frost action and shrink-swell potential. Drainage should be provided around foundations and backfilled with suitable material. For local roads and streets to function properly, the surface layer of the Pert soil should be replaced or covered with suitable base material. Capability subclass IIIw, Michigan soil management group 1b.

PpA—Pipestone-Tedrow loamy sands, 0 to 2 percent slopes. This map unit is about 50 to 55 percent Pipestone soils and 30 to 43 percent Tedrow soils. These soils are nearly level and somewhat poorly drained and are on low knolls and ridges. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 100 acres in size. The soils are so intricately mixed, or so small in extent, that it is not practical to map them separately.

Typically, the surface layer of the Pipestone soil is very dark grayish brown loamy sand about 6 inches thick. The subsurface layer is light gray sand about 3 inches thick. The subsoil is mottled, loose sand about 35 inches thick. The upper part of the subsoil is dark brown, 7 inches thick; the middle part is light yellowish brown, 15 inches thick; and the lower part is brown, 13 inches thick. The substratum, to a depth of 60 inches, is grayish brown, mottled sand. In some places, the upper part of the subsoil has a 6- to 10-inch layer of discontinuous, cemented material.

Typically, the surface layer of the Tedrow soil is very dark grayish brown loamy sand about 9 inches thick. The subsoil is mottled, loose sand. The upper part of the subsoil is yellowish brown, 8 inches thick; the middle part is brown, 12 inches thick; and the lower part is pale brown, 16 inches thick. The substratum, at a depth of 45 inches, is light brownish gray, calcareous sand.

Included with these soils in mapping are small areas of poorly drained and very poorly drained Kingsville, Belleville, and Sickles soils in depressions and drainageways. These soils make up 1 to 8 percent of the mapped areas. Also included are small areas of Wixom soils on low knolls and ridges, or in a slightly lower position or in depressions. These soils make up 0 to 5 percent of the mapped areas. They have a higher available water capacity in the lower part of the profile than the Pipestone or Tedrow soil. In addition, there are a few areas of soils that are similar to the Pipestone and Tedrow soils, except they are moderately well drained.

Permeability is rapid, and the available water capacity is low. Runoff is slow.

These soils are mostly in native vegetation, including trees. In a few areas, they are used for crops (fig. 3). These soils have good potential for pasture and fair potential for crops and woodland.

If these soils are used for cultivated crops, removing excess water in wet periods in spring, conserving moisture in dry summers, controlling soil blowing, and maintaining high organic-matter content are major management requirements. Artificial drainage can be used to remove excess water. Stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If these soils are used for pasture, excess water during wet periods in spring and droughtiness during dry summers are major management problems. Grazing is restricted in wet months, and growth is reduced in dry summers.

If these soils are used for trees, seedling mortality is the major hazard. Some seedling losses can be expected, because of droughtiness in dry summers.

These soils have severe limitations for most engineering uses. For such uses, they must be artificially drained by using surface ditches and tile drains. Caving of cutbanks in shallow excavations can be prevented by removing excess water, constructing retaining walls, and maintaining the proper slope grade. The included soils that are similar to the Pipestone and Tedrow soils, except they are moderately well drained, are better suited to some engineering uses. Capability subclass IVw, Michigan soil management group 5b.

PrA—Pipestone-Tedrow loamy sands, loamy substratum, 0 to 2 percent slopes. This map unit is about 40 to 45 percent Pipestone, loamy substratum soils and 30 to 40 percent Tedrow, loamy substratum soils. These soils are nearly level and somewhat poorly drained and are on low knolls and ridges. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 180 acres in size. The two soils are so intricately mixed, or so small in extent, that it is not practical to map them separately.

Typically, the surface layer of the Pipestone, loamy substratum soil is very dark gray loamy sand about 9 inches thick. The subsoil is mottled, loose sand about 40 inches thick. In sequence from the top, the subsoil is dark brown, brownish yellow, pale brown, and light grayish brown. The substratum, to a depth of 60 inches, is light grayish brown, mottled, calcareous clay loam. In some places, the upper part of the subsoil has a 6- to 10-inch layer of cemented material that is generally discontinuous.

Typically, the surface layer of the Tedrow, loamy substratum soil is very dark grayish brown loamy sand about 9 inches thick. The subsoil is loose sand and consists of 4 layers. The first layer is yellowish brown, 6 inches thick; the second layer is light yellowish brown and mottled, 14 inches thick; the third layer is brown and mottled, 17 inches thick; and the fourth layer is grayish brown and mottled, 7 inches thick. The substratum, at a depth of 53 inches, is light grayish brown, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Wixom and Selfridge soils on low knolls and ridges; they make up 3 to 10 percent of the mapped areas. The Wixom and Selfridge soils have a higher available water capacity in the subsoil than the Pipestone or Tedrow, loamy substratum soil. Also included are small areas of very poorly drained and poorly drained Kingsville and Belleville soils in depressions and drainageways; they make up 1 to 8 percent of the mapped areas.

Permeability is rapid in the sandy upper part and moderately slow in the loamy lower part. The available water capacity is moderate for both soils. Runoff is slow.

These soils are mostly in native vegetation, including trees. In a few areas, they are used for crops. These soils have good potential for pasture, and fair potential for woodland and crops, and as habitat for openland and woodland wildlife.

If these soils are used as cultivated crops, removing excess water during wet periods in spring, conserving moisture during dry summers, controlling soil blowing, and maintaining high organic-matter content are major management requirements. Artificial drainage can be used to remove excess water. Stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If these soils are used for pasture, excess water during wet periods in spring and droughtiness during dry summers are major management problems. Grazing is restricted during wet periods in spring, and growth is reduced during dry summers.

If these soils are used for trees, seedling mortality is the major problem. Some seedling losses can be expected, because of droughtiness during dry summers.

These soils have severe limitations for most engineering uses. For such uses, they must be artificially drained by using surface ditches and tile drains. Using a sealer or restrictive layer of impervious material can prevent seepage caused by sewage lagoons and sanitary landfills. Removing excess water, constructing retaining walls, and maintaining the proper slope grade can prevent caving of cutbanks in shallow excavations. Capability subclass IIIw, Michigan soil management group 5/2b.

Ps—Pits. These areas are open excavations from which soil and underlying material have been removed. They expose material that supports few or no plants. Pits vary considerably in size and in shape. They range from 2 to 300 acres in size and are 5 feet or more in depth.

Included with Pits in mapping are small areas of Aquents, Udorthents, and water.

Permeability, available water capacity, and reaction are too variable to rate for these areas.

Areas are idle with little or no vegetation. Onsite investigation is needed to determine the potential use of these areas for development of wildlife habitat and for recreational uses.

PtB—Plainfield loamy sand, 0 to 6 percent slopes. This is a nearly level and gently sloping, excessively drained soil on knolls and ridges of uplands. Slopes are smooth and convex and are less than 100 feet long. The areas are irregular in shape and are 2 to 400 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 7 inches thick. The subsoil is yellowish brown and brownish yellow, loose sand about 23 inches thick. The substratum, to a depth of 60 inches, is yellow and very pale brown sand. In some places, slopes exceed 6 percent.

Included with this soil in mapping are small areas of Boyer soils on knolls and ridges of uplands; they make up 5 to 18 percent of the mapped areas. The Boyer soil has a higher available water capacity in the subsoil than the Plainfield soil. Also included are small areas of somewhat poorly drained Tedrow and Riverdale soils on low knolls and ridges at a lower elevation than the Plainfield soil. These soils make up 2 to 8 percent of the mapped areas. Small areas of poorly drained and very poorly drained Kingsville and Vestaburg soils in depressions and drainageways are included; they make up 1 to 8 percent of the mapped areas. Also included are small areas of soils similar to this Plainfield soil, except they are moderately well drained; they make up 5 to 20 percent of the mapped areas. This soil is in a slightly lower position on the landscape than the Plainfield soil.

Permeability is rapid, and the available water capacity is low. Runoff is slow.

This soil is mostly in permanent vegetation, including trees. In a few areas, it is used for crops and pasture. This soil has good potential for pasture. It has fair potential for crops, woodland, and recreational use.

If this soil is used for cultivated crops, soil blowing and droughtiness are major problems. Controlling soil blowing, maintaining a high organic-matter content, and conserving moisture are major management requirements. Stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, droughtiness is the major hazard. Growth is reduced during dry summers. The use of deep-rooted, drought-resistant plants will help overcome droughtiness.

If this soil is used for trees, seedling mortality and plant competition are major management problems. Some seedling losses can be expected because of the low available water capacity. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

The soil has slight limitations for dwellings, small commercial buildings, and local roads and streets. It has moderate or severe limitations for sewage lagoons, sanitary landfills, and shallow excavations. Using a sealer or restrictive layer of impervious material can prevent seepage caused by sewage lagoons and sanitary landfills. Constructing retaining walls and maintaining the proper slope grade can prevent caving of cutbanks in shallow excavations. Lawns should have a cover of loamy topsoil and must be watered frequently. Cleared areas around construction sites should be protected from soil blowing by mulching, using an asphalt spray, netting, grass seeding or sodding with fertilization, planting clumps of grass, keeping cleared areas to a minimum size, and constructing windbreaks or snowfences. Capability subclass IVs, Michigan soil management group 5a.

PtC—Plainfield loamy sand, 6 to 18 percent slopes. This is a moderately sloping to rolling, excessively drained soil on knolls and ridgetops. Slopes are smooth and convex and are less than 200 feet long. The areas are irregular in shape and are 2 to 50 acres in size.

Typically, the surface layer is dark grayish brown sand about 7 inches thick. The subsoil is yellowish brown and brownish yellow, loose sand about 23 inches thick. The substratum, to a depth of 60 inches, is yellow and very pale brown sand. In some places, slopes are less than 6 percent.

Included with this soil in mapping are small areas of Boyer and Arkport soils on knolls and ridgetops; they make up 2 to 15 percent of the mapped areas. The Boyer soil has a higher available water capacity in the subsoil and the Arkport soil has a higher available water capacity than this Plainfield soil. Also included is the somewhat poorly drained Tedrow soil on foot slopes in narrow drainageways and the poorly drained and very poorly drained Kingsville soil in depressions and drainageways. These soils make up 1 to 8 percent of the mapped areas.

Permeability is rapid, and the available water capacity is low. Runoff is medium.

This soil is mostly in permanent vegetation, including trees. In a few areas, it is used for pasture or crops. This soil has fair potential for pasture, woodland, and recreational use and poor potential for crops.

This soil should not be used for cultivated crops because of droughtiness and soil blowing.

If this soil is used for pasture, droughtiness is the major hazard. Growth is reduced during dry summers. The use of deep-rooted, drought-resistant plants will help overcome droughtiness.

If this soil is used for trees, seedling mortality and plant competition are major management problems. Some seedling losses can be expected, because of the low available water capacity. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has moderate or severe limitations for most engineering uses. Construction sites and roads and streets need landforming and should be on the contour. Lawns should have a cover of loamy topsoil and must be watered frequently. Cleared areas around construction sites should be protected from soil blowing by mulching, using an asphalt spray, netting, grass seeding or sodding with fertilization, plantings clumps of grass, keeping cleared areas to a minimum size, or constructing windbreaks or snowfences. Using a sealer or restrictive layer of impervious material can prevent seepage caused by sewage lagoons and sanitary landfills. Constructing retaining walls and maintaining the proper slope grade can prevent caving of cutbanks in shallow excavations. Capability subclass VIs, Michigan soil management group 5a.

RdA—Riverdale loamy sand, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges. Slopes are slightly convex and are less than 100 feet long. The areas are irregular in shape and are 2 to 100 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsoil is mottled, and it is about 25 inches thick. The upper part of the subsoil is strong brown, very friable loamy sand, 6 inches thick; the middle part is pale brown, loose sand, 14 inches thick; and the lower part is yellowish brown, friable gravelly sandy loam, 5 inches thick. The substratum, to a depth of 60 inches, is grayish brown, calcareous gravelly sand.

Included with this soil in mapping are small areas of soils similar to the Tedrow soil, except they generally have a high content of pebbles throughout the profile. These soils are on low knolls and ridges; they make up 10 to 18 percent of the mapped areas. They have a lower available water capacity than the Riverdale soil. Also included are small areas of poorly drained and very poorly drained Kingsville, Gilford, and Vestaburg soils in depressions; they make up 1 to 8 percent of the mapped areas. Small areas of a soil similar to the Riverdale soil, except it is moderately well drained, are also included. These areas are generally on slightly higher knolls and ridges, and they make up 5 to 15 percent of the mapped areas.

Permeability is moderately rapid, and the available water capacity is low. Runoff is slow.

This soil is mostly in native vegetation, including trees. In a few areas, it is used for crops. This soil has fair potential for crops and woodland and good potential for pasture.

If this soil is used for cultivated crops, removing excess water in wet periods, controlling soil blowing, conserving moisture in dry periods, and maintaining high organic-matter content are major management requirements. Artificial drainage is needed to remove excess water. Stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of manure and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, wetness in spring and droughtiness during dry summers are the major problems. Grazing is restricted in wet periods, and growth is reduced in dry periods.

If this soil is used for trees, seedling mortality is moderate, because of the sandy surface layer.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches and tile drains. Removing excess water, constructing retaining walls, and maintaining the proper slope grade can prevent caving of cutbanks in shallow excavations. The moderately well drained soil that is included in mapping is better suited to most engineering uses. Capability subclass IIIw, Michigan soil management group 4b.

Sa—Saranac silty clay loam, frequently flooded. This is a nearly level, poorly drained and very poorly drained soil on flood plains. The areas are irregular in shape and are 2 to 500 acres in size.

Typically, the surface layer is about 23 inches thick. The upper part of the surface layer is about 12 inches thick, and the lower part is dark gray silty clay loam about 11 inches thick. The subsoil is gray, mottled, very firm silty clay about 14 inches thick. The substratum, to a depth of 60 inches, is 3 inches of very dark brown silty clay loam, 15 inches of gray silty clay, and 5 inches of dark gray silty clay. In some places, the substratum, below 40 inches, is gravelly sand.

Included with this soil in mapping are small areas of Sloan and Palms soils also on flood plains. These soils make up 1 to 8 percent of the mapped areas. They have a higher available water capacity than this Saranac soil.

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

This soil is mostly in permanent vegetation, including trees. In a few areas, it is used for pasture or crops. This soil has good potential as habitat for wetland wildlife. It has poor potential for woodland, crops, and pasture.

Because this soil is frequently flooded, it generally is not used for cultivated crops. Flooding and frost action are major hazards. Wetness and lack of adequate drainage outlets are major management problems. These hazards and management problems make the use of this soil for crops impractical.

If this soil is used for pasture, flooding is the major hazard. Grazing is restricted in wet periods.

If this soil is used for trees, windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are major management problems. This soil is flooded or is wet throughout much of the year, which causes trees to blow down during storms and seedling losses to be high. The use of heavy equipment for planting and harvesting trees is restricted. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses, because of wetness, flooding, frost action, excessive clay, and slow percolation. For local roads and streets to function properly, the surface layer of the Saranac soil should be covered with suitable base material. Capability subclass Vw, Michigan soil management group L-2c.

SeA—Selfridge loamy sand, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges. It is subject to rare flooding. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 80 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsoil is mottled, and it is about 27 inches thick. The upper part is brown, very friable loamy sand, 13 inches thick. The middle part is light yellowish brown, loose sand, 10 inches thick. The lower part is brown, friable loam, 4 inches thick. The substratum, to a depth of 60 inches, is brown and grayish brown, mottled, calcareous clay loam. In small areas of the Maple River State Game Area in Fulton Township, a soil similar to this Selfridge soil has many cobbles and some stones on the surface layer and in the subsoil.

Included with this soil in mapping are small areas of Capac, Metamora, and Dixboro soils on low knolls and ridges. These soils make up 5 to 13 percent of the mapped areas. They have a higher available water capacity in the upper part of the solum than the Selfridge soil. Also included are small areas of poorly drained and very poorly drained Parkhill, Belleville, and Corunna soils in flat depressions and drainageways; and the well drained Metea soil on higher knolls and ridges. These soils make up 1 to 8 percent of the mapped areas.

Permeability is rapid in the sandy upper part and moderate or moderately slow in the loamy lower part. The available water capacity is moderate. Runoff is slow.

This soil is used mostly for crops. In a few areas, it is used for pasture, or it is in native vegetation, including trees. This soil has good potential for pasture and as habitat for woodland wildlife. It has fair potential for crops, woodland, and recreation use.

If this soil is used for cultivated crops, removing excess water in wet periods, conserving soil moisture in dry periods, controlling soil blowing, and maintaining high organic-matter content are major management requirements. Artificial drainage is needed to remove excess water. Stubble mulching, and using minimum tillage, cover crops, buffer strips, and windbreaks are practices that help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve moisture.

If this soil is used for pasture, wetness in spring and droughtiness in dry summers are major management problems. Grazing is restricted in wet periods, and growth is reduced in dry periods.

If this soil is used for trees, equipment limitations, seedling mortality, and plant competition are the major management problems. The use of heavy equipment for planting and harvesting trees is restricted during wet periods in spring. Some plant seedling losses can be expected during dry summers. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches and tile drains. Dwellings and small commercial buildings with basements should not be constructed on this soil. Footings and foundations should be designed to prevent structural damage caused by frost action and by shrink-swell potential. The sandy surface layer of this soil will cave in shallow excavations. Constructing retaining walls, maintaining the proper slope grade, and removing excess water from the excavation can prevent this. Capability subclass IIIw, Michigan soil management group 4/2b.

Sk—Sickles loamy sand. This is a nearly level, poorly drained and very poorly drained soil in broad, flat areas; in swamps; and in drainageways. The areas are irregular in shape and are 2 to 200 acres in size.

Typically, the surface layer is black loamy sand about 9 inches thick. The substratum, to a depth of 25 inches, is dark gray, very friable loamy sand; and to a depth of 36 inches, is gray, loose sand. Below that, the substratum, to a depth of 60 inches, is gray, calcareous silty clay.

Included with this soil in mapping are small areas of Lenawee, Toledo, Wauseon, and Kingsville soils in broad, flat areas; in swamps; and in drainageways. These soils make up 0 to 15 percent of the mapped areas. The Lenawee, Toledo, and Wauseon soils have a higher available water capacity in the upper part of the profile and the Kingsville soil has a lower available water capacity than the Sickles soil. Also included are small areas of somewhat poorly drained Arkona and Tedrow soils on low knolls and ridges; they make up 0 to 5 percent of the mapped areas.

Permeability is rapid in the sandy upper part and slow in the clayey lower part. The available water capacity is low. Runoff is very slow or ponded.

This soil is mostly in native vegetation, including trees. In a few areas, it is used for crops and pasture. This soil has good potential for pasture. It has fair potential for crops, and as habitat for wetland wildlife. It has poor potential for woodland.

If this soil is used for cultivated crops, removing excess water in wet periods, conserving soil moisture in dry periods, controlling soil blowing, and maintaining high organic-matter content are major management requirements. Artificial drainage is needed to remove excess water. The use of minimum tillage, stubble mulch, cover crops, buffer strips, and windbreaks help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter.

Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, excess water in wet periods and droughtiness in dry summers are major management problems. Artificial drainage is needed to remove excess water. Grazing is restricted in wet periods, and growth is reduced in dry periods.

If this soil is used for trees, windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are major management problems. Because of wetness, seedling losses are high, and trees blow down during storms. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for engineering uses, because of wetness, seepage, and caving of cutbanks. Using a sealer or restrictive layer of impervious material reduces seepage. Constructing retaining walls, maintaining the proper slope grade, and removing excess water help reduce caving of cutbanks. Using surface ditches and tile drains and connecting sanitary facilities to commercial sewers and treatment facilities help reduce wetness. Capability subclass IIIw, Michigan soil management group 4/1c.

Sn—Sloan loam, wet. This is a nearly level, very poorly drained soil on flood plains. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 200 acres in size.

Typically, the surface layer is about 20 inches thick. The upper part of the surface layer is very dark brown loam about 11 inches, and the lower part is dark gray loam about 9 inches thick. The subsoil is about 27 inches thick. The upper part of the subsoil is very dark gray, mottled, firm loam 11 inches thick. The middle part is black, friable silt loam 4 inches thick. The lower part is gray, mottled, friable silt loam 12 inches thick. The substratum, to a depth of 60 inches, is gray, mottled, calcareous, stratified sandy loam and silt loam. In some places, the substratum is gravelly sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Ceresco soil and a soil similar to the Sloan soil, except it is somewhat poorly drained. These soils are on low knolls and ridges on the flood plain, and they make up 1 to 5 percent of the mapped areas. Also included are small areas of Cohoctah and Palms soils on flood plains; they make up 1 to 9 percent of the mapped areas. The Cohoctah soil has a lower available water capacity, and the Palms soil has a higher available water capacity than this Sloan soil.

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

This soil is mostly in permanent vegetation, including trees. In a few areas, it is used for pasture or crops. This soil has good potential as habitat for woodland and wetland wildlife. It has poor potential for crops and pasture.

This soil generally is not used for cultivated crops. Flooding and frost action are major hazards. Excess water and the lack of adequate drainage outlets are major management problems. Methods to reduce these problems, although they are not economically feasible, include the construction of dikes, installation of artificial drainage, and the use of lift pumps.

If this soil is used for pasture, flooding is the major hazard. This soil will flood or have excess water throughout much of the year. Grazing is restricted in wet periods. Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are major management problems. This soil floods or is wet throughout much of the year, causing trees to blow down during storms and seedling losses to be high. Use of heavy equipment for planting and harvesting trees is restricted. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For local roads and streets to function properly, the surface layer of the Sloan soil should be covered with suitable base material. Capability subclass Vw, Michigan soil management group L-2c.

SpB—Spinks loamy sand, 0 to 6 percent slopes. This is a nearly level and gently sloping, well drained soil on foot slopes, knolls, and ridges. Slopes are smooth and convex and are less than 100 feet long. The areas are irregular in shape and are 2 to 100 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, loose sand about 11 inches thick. The next layer is yellowish brown loose sand with bands of dark brown, very friable loamy sand about 26 inches thick. The substratum, to a depth of 60 inches, is pale brown sand. In some places, the slope exceeds 6 percent. In some areas, there is gravelly sand below 24 inches.

Included with this soil in mapping are small areas of Arkport soils that are slightly lower in elevation or are on foot slopes, knolls, and ridges. These soils make up 5 to 15 percent of the mapped areas. The Arkport soil has a higher available water capacity than the Spinks soil. Also included are small areas of somewhat poorly drained Tedrow and Riverdale soils on low knolls and ridges at a lower elevation than the Spinks soil. These soils make up 1 to 8 percent of the mapped areas. Small areas of soils similar to the Spinks soil, except they are moderately well drained and are generally on the lower slopes, are also included. These soils make up 5 to 13 percent of the mapped areas.

Permeability is moderately rapid or rapid, and the available water capacity is low. Runoff is slow.

This soil is used mostly for crops. In a few areas, it is used for pasture, or it is in permanent vegetation, including trees. This soil has good potential for pasture, woodland, and as habitat for woodland wildlife. It has fair potential for crops and recreation uses.

If this soil is used for cultivated crops, soil blowing and droughtiness are major problems. The major management requirements are controlling soil blowing, maintaining high organic-matter content, and conserving moisture. Practices that help control soil blowing are stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve soil moisture. Legumes need additional applications of lime.

If this soil is used for pasture, droughtiness is the major hazard. Growth is reduced during dry summers. The use of deep-rooted, drought-resistant plants will help overcome droughtiness.

If this soil is used for trees, seedling mortality is a moderate management problem. Some seedling losses can be expected during dry summers.

This soil has slight limitations for many engineering uses, such as septic tank absorption fields, dwellings, small commercial buildings, and local roads and streets. It has severe limitations for shallow excavations because the cutbanks cave, and for sewage lagoons and sanitary landfills because it percolates rapidly and causes seepage. Methods to prevent caving of cutbanks include constructing retaining walls and maintaining the proper slope grade. Using a sealer or restrictive layer of impervious material can reduce seepage. Capability subclass IIIs, Michigan soil management group 4a.

SpC—Spinks loamy sand, 6 to 12 percent slopes. This is a moderately sloping or gently rolling, well drained soil on knolls and ridgetops. Slopes are smooth and convex and are generally less than 100 feet long. The areas are irregular in shape and are 2 to 100 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, loose sand about 11 inches thick. The next layer is light yellowish brown, loose sand with bands of dark brown, very friable loamy sand about 23 inches thick. The substratum, to a depth of 60 inches, is pale brown sand. In some places, the slopes are less than 6 percent or they exceed 12 percent. In some areas, there is gravelly sand below 30 inches.

Included with this soil in mapping are small areas of Arkport soils on knolls and ridgetops; they make up 5 to 12 percent of the mapped areas. These soils have a higher available water capacity than the Spinks soils. Also included are small areas of somewhat poorly drained Tedrow and Riverdale soils on foot slopes and in drainageways; they make up 2 to 8 percent of the mapped areas.

Permeability is moderately rapid or rapid, and the available water capacity is low. Runoff is medium.

This soil is used mostly for crops, or it is in permanent vegetation, including trees. In a few areas, it is used for pasture. This soil has good potential for pasture, woodland, and as habitat for woodland wildlife. It has fair potential for crops and recreational uses.

If this soil is used for cultivated crops, erosion, soil blowing, and droughtiness are major problems. The major management requirements are controlling runoff and erosion, maintaining high organic-matter content, and conserving moisture. Stubble mulching and using crop rotations with hay, minimum tillage, cover crops, buffer strips, and windbreaks are practices that help control soil blowing. Using cover crops, minimum tillage, and sod waterways help control runoff and erosion. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve soil moisture. Legumes need additional applications of lime.

If this soil is used for pasture, droughtiness is the major hazard. Growth is reduced in dry summers. The use of deep-rooted, drought-resistant plants will help overcome droughtiness.

If this soil is used for trees, seedling mortality is a moderate management problem. Some seedling losses can be expected in dry summers.

This soil has moderate or severe limitations for most engineering uses, because of slope, seepage, and caving of cutbanks. Methods of reducing the slope limitation include landforming and contouring roads and streets. Using a sealer or restrictive layer of impervious material reduces seepage. Constructing retaining walls and maintaining the proper slope grade prevent the caving of cutbanks. Capability subclass IIIe, Michigan soil management group 4a.

TdA—Tedrow loamy sand, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 200 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsoil is mottled, loose sand, and it is about 36 inches thick. The upper part of the subsoil is yellowish brown, 8 inches thick; the middle part is brown, 12 inches thick; and the lower part is pale brown, 16 inches thick. The substratum, to a depth of 60 inches, is light brownish gray, calcareous sand. In some places, the subsoil and substratum contain thin bands of loamy sand, gravelly sand, or light sandy loam, or they have a higher percentage of pebbles. Also in some places, there is gravelly sand below 26 inches.

Included with this soil in mapping are small areas of poorly drained and very poorly drained Kingsville, Sickles, and Belleville soils in depressions and drainageways. These soils make up 2 to 8 percent of the mapped areas. Also included are small areas of the well drained Oakville soil on slightly higher knolls and ridges; they make up 2 to 10 percent of the mapped areas.

Permeability is rapid, and the available water capacity is low. Runoff is slow.

This soil is mostly in native vegetation, including trees. In a few areas, it is used for crops or pasture. This soil has good potential for pasture and fair potential for woodland. It has poor potential for crops.

If this soil is used for cultivated crops, removing excess water during wet periods in spring, conserving moisture during dry summers, controlling soil blowing, and maintaining high organic-matter content are major management requirements. Artificial drainage is needed to remove excess water. Stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks are practices that help control soil blowing. Frequent additions of crop residue, manure, and green manure help maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, excess water during wet periods in spring and droughtiness during dry summers are major management problems. Grazing is restricted in wet periods, and growth is reduced in dry periods.

If this soil is used for trees, seedling mortality and plant competition are major problems. Some seedling losses can be expected because of droughtiness during dry summers. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches and tile drains. Lawns need a cover of loamy topsoil and should be watered frequently. Cleared areas around construction sites should be protected from soil blowing by mulching, spraying with asphalt, netting, seeding with grass, establishing sod that is properly fertilized, planting clumps of grass, keeping cleared areas to a minimum size, or constructing windbreak or snow fences. Removing excess water, constructing retaining walls, and maintaining the proper slope grade can prevent caving of cutbanks in shallow excavations. The included well drained Oakville soil is on a slightly higher elevation than this Tedrow soil and is better suited to some engineering uses. Capability subclass IIIw, Michigan soil management group 5b.

TeA—Tedrow loamy sand, loamy substratum, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 50 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsoil is loose sand, and it is about 44 inches thick. The first layer is yellowish brown, the second layer is light yellowish brown and mottled, the third layer is brown and mottled, and the fourth layer is grayish brown and mottled. The substratum, to a depth of 60 inches, is light grayish brown, mottled, calcareous clay loam. Included in some places is a soil similar to Tedrow soils, except it has cobbles in the surface layer and in the upper part of the subsoil. Also, in some places, the lower part of the subsoil is heavy loam sand, or the sandy material extends to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Selfridge and Dixboro soils on low knolls and ridges. These soils make up 1 to 8 percent of the mapped areas. They have a higher available water capacity in the solum than the Tedrow loamy substratum soil. Also included are small areas of poorly drained and very poorly drained Kingsville and Belleville soils in depressions and drainageways; they also make up 1 to 8 percent of the mapped areas.

Permeability is rapid in the sandy upper part and moderately slow in the loamy lower part. The available water capacity is moderate.

This soil is used mostly for crops, or it is in native vegetation, including trees. It has good potential for pasture. It has fair potential for crops and woodland and as habitat for openland, woodland, and wetland wildlife.

If this soil is used for cultivated crops, removing excess water during wet periods in spring, conserving moisture during dry summers, controlling soil blowing, and maintaining high organic-matter content are major management requirements. Artificial drainage is needed to remove excess water. Stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks are practices that help control soil blowing. Frequent additions of crop residue, manure, and green manure are needed to maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, excess water during wet periods in spring and droughtiness during dry summers are major management problems. Grazing is restricted in wet periods, and growth is reduced in dry periods.

If this soil is used for trees, equipment limitations, seedling losses, and plant competition are major problems. The use of heavy equipment for planting and harvesting trees is restricted during wet periods in spring. Some seedling losses can be expected, because of droughtiness in dry summers. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. It has moderate limitations for dwellings without basements, small commercial buildings, and local roads and streets. The major limitations of the soil for urban use include wetness and caving of cutbanks. Using surface ditches and tile drains helps to reduce wetness. Cleared areas around construction sites should be protected from soil blowing by mulching, spraying with asphalt, netting, seeding with grass, establishing sod that is properly fertilized, planting clumps of grass, keeping cleared areas to a minimum size, or constructing windbreaks or snow fences. Constructing retaining walls, maintaining the proper slope grade, and removing excess water from excavations help prevent caving of cutbanks. Capability subclass IIIw, Michigan soil management group 5/2b.

Th—Thomas muck. This is a nearly level, poorly drained and very poorly drained soil in broad, flat areas; in swamps; and in drainageways. It is subject to occasional flooding. The areas are irregular in shape and are 5 to 120 acres in size.

Typically, the surface layer is black muck about 9 inches thick. The subsoil is dark gray, mottled, firm clay loam about 8 inches thick. The substratum, to a depth of 60 inches, is gray, mottled, and calcareous. The upper part is clay loam, and the lower part is loam. In some places, the subsoil and substratum have coarser textured layers. Also, in some places the subsoil contains a thin layer of organic material, or there is a thin layer of sedimentary peat directly below the organic surface layer.

Included with this soil in mapping are small areas of Martisco and Palms soils in broad, flat areas; in swamps; and in drainageways. These soils make up 0 to 15 percent of the mapped areas. The Martisco soil has variable available water capacity in the marl and the Palms soil has a very high available water capacity in the organic materials to a greater depth than this Thomas soil.

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

This soil is used mostly for pasture, or it is in native vegetation, including trees. In a few areas, it is used for crops. This soil has good potential for crops and pasture and as habitat for wetland wildlife. It has poor potential for woodland.

If this soil is used for cultivated crops, excess water and the lack of adequate drainage outlets are major management problems. Frost is the major hazard. Installation of artificial drainage and lift pumps is a method of overcoming these problems.

If this soil is used for pasture, wetness is the major problem. Grazing is restricted in wet periods. Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, equipment limitations, seedling mortality, windthrow, and plant competition are major management problems, because of wetness. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. Seedling losses are high, and trees may blow down during storms. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches and tile drains. Footings and foundations should be designed to prevent structural damage caused by frost action. The organic layers of the soil should be replaced with suitable base material. Capability subclass IIw, Michigan soil management group 1.5c-c.

Tm—Tobico muck. This is a nearly level, poorly drained and very poorly drained soil in broad, flat areas and drainageways. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 300 acres in size.

Typically, the surface layer is black muck about 9 inches thick. The substratum, to a depth of 60 inches, is dark gray, grayish brown, and gray, mottled, calcareous sand. Included are some areas in which the organic material is 10 to 16 inches thick. Also, in many places the upper part of the substratum is loamy sand or loamy fine sand.

Included with this soil in mapping are small areas of Adrian, Gilford, and Lamson soils in broad, flat areas and drainageways. These soils make up 1 to 15 percent of the mapped areas. They have a higher available water capacity to greater depths than this Tobico soil.

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

This soil is mostly in permanent vegetation, including trees. In a few areas, it is used for pasture or crops. This soil has good potential for pasture. It has fair potential for crops and as habitat for wetland wildlife. It has poor potential for woodland.

If this soil is used for cultivated crops, removing excess water and controlling soil blowing are major management requirements. Artificial drainage helps remove excess water. Stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks are practices that help control soil blowing (fig. 4). In areas where the organic layer is thin, soil blowing may expose the less fertile, sandy substratum.

If this soil is used for pasture, removing excess water is the major management requirement. Grazing is restricted in wet periods. Artificial drainage helps remove excess water and thereby increase yields. Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are major management problems. Because of wetness, seedling losses are high, and trees may blow down during storms. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches and tile drains. For local roads and streets to function properly, the organic layer of the Tobico soil should be removed and replaced with suitable base material. Removing excess water, constructing retaining walls, and maintaining the proper slope grade can prevent caving of cutbanks in shallow excavations. Capability subclass IIIw, Michigan soil management group 5c-c.

To—Toledo clay loam. This is a nearly level, very poorly drained soil in broad, flat areas and drainageways. The areas are irregular in shape and 5 to 500 acres in size.

Typically, the surface layer is dark grayish brown clay loam about 9 inches thick. The subsoil is mottled, and it is about 39 inches thick. The upper part of the subsoil is dark gray, firm clay loam 4 inches thick; the middle part is gray, firm silty clay 6 inches thick; and the lower part is gray, very firm silty clay 29 inches thick. The substratum, to a depth of 60 inches, is gray, very firm calcareous silty clay. In some places, the substratum, below 50 inches, is stratified very fine sand and silt.

Included with this soil in mapping are small areas of Sickles soil in depressions and drainageways, and somewhat poorly drained Pert and Arkona soils on low knolls and ridges. These soils make up 2 to 10 percent of the mapped areas. The Sickles soil has a lower available water capacity than this Toledo soil.

Permeability is slow, and the available water capacity is moderate. Runoff is very slow or ponded (fig. 5).

This soil is used mostly for crops. In a few areas, it is used for pasture, or it is in native vegetation, including trees. This soil has good potential for pasture and as habitat for wetland wildlife. It has fair potential for crops and woodland.

If this soil is used for cultivated crops, removing excess water and maintaining good tilth are major management requirements. Surface and subsurface drainage must be provided because of the high water table and the slow permeability. Tilling within the proper range of moisture content, using minimum tillage, and incorporating crop residue into the plow layer are practices that help maintain good tilth.

If this soil is used for pasture, removing excess water and maintaining good soil structure and tilth are major management requirements. Artificial drainage helps remove excess water. Restricted grazing in wet periods reduces compaction of the surface layer and maintains soil structure.

If this soil is used for trees, windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are major management problems. Because of wetness, seedling losses are high, and some trees blow down during storms. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches or tile drains. Dwellings and small buildings with basements should not be constructed on this soil. Footings and foundations should be designed to prevent structural damage caused by frost action and by shrinking and swelling. For local roads and streets to function properly, the surface layer of the Toledo soil should be replaced or covered with suitable base material. Capability subclass IIIw, Michigan soil management group 1c.

Ts—Toledo-Sickles complex. This map unit consists of nearly level, poorly drained and very poorly drained soils in broad, flat areas and in drainageways. The areas are irregular in shape and are 2 to 300 acres in size. The Toledo soil makes up about 55 to 65 percent of this map unit and the Sickles soil makes up 25 to 30 percent. These soils are so intricately mixed, or so small in extent, that it is not practical to separate them at the scale used for mapping.

Typically, the surface layer of the Toledo soil is dark grayish brown clay loam about 9 inches thick. The subsoil is gray, mottled, very firm silty clay about 39 inches thick. The substratum, to a depth of 60 inches, is gray, calcareous silty clay. In some places, the surface layer is loamy sand.

Typically, the surface layer of the Sickles soil is black loamy sand about 9 inches thick. The substratum, to a depth of 25 inches, is dark gray, very friable loamy sand; and to a depth of 36 inches, is gray, loose sand. Below that, the substratum, to a depth of 60 inches, is gray, calcareous silty clay.

Included with these soils in mapping are small areas of somewhat poorly drained Pert and Arkona soils on low knolls and ridges; they make up 1 to 8 percent of the mapped areas.

Permeability is slow in the Toledo soil; and in the Sickles soil, it is rapid in the sandy upper part and slow in the clayey lower part. The available water capacity is moderate in the Toledo soil and low in the Sickles soil. Runoff is very slow or ponded.

These soils are used mostly for crops. In a few areas, they are used for pasture, or they are in native vegetation, including trees. These soils have good potential for pasture and as habitat for wetland wildlife. They have fair potential for crops and woodland.

If these soils are used for cultivated crops, removing excess water is the major management requirement. Maintaining good tilth in the Toledo soil and conserving soil moisture during dry periods, controlling soil blowing, and maintaining high organic-matter content in the Sickles soil are also major management requirements. Surface and subsurface drainage should be used to remove excess water. Tilling within the proper range of moisture content, using minimum tillage, and incorporating crop residue into the plow layer are practices that help maintain good tilth in the Toledo soil. Stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks are practices that help control soil blowing on the Sickles soil. Frequent additions of crop residue, manure, and green manure are needed to maintain content of organic matter in the Sickles soil. Crop residue and minimum tillage also conserve moisture in the Sickles soil. The clayey material in the Toledo soil has a narrower range of proper moisture content for tillage. Therefore, this soil can only be tilled when the clayey material is at the proper moisture content. Also, tillage equipment penetrates the sandy material more than the clayey material. Therefore, the depth of plowing, seed placement, and cultivation will be greater in the sandy material of the Sickles soil.

If these soils are used for pasture, removing excess water is the major management requirement. In addition, maintaining good soil structure and tilth are management requirements for the Toledo soil. Artificial drainage helps remove excess water. Restricted grazing in wet periods reduces compaction of the surface layer and maintains soil structure. Pasture plants that are tolerant of wetness should be selected.

If these soils are used for trees, windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are major management problems. Because of wetness, seedling losses are high, and trees blow down during storms. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. Sites must be intensively prepared and maintained, because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

These soils have severe limitations for most engineering uses. For such uses, they must be artificially drained by using surface ditches or tile drains. Dwellings and small buildings with basements should not be constructed on this soil. Footings and foundations should be designed to prevent structural damage caused by frost action and by shrinking and swelling. For local roads and streets to function properly, the clay loam surface layer of the Toledo soil should be replaced or covered with suitable base material. Constructing retaining walls, maintaining the proper slope grade, and removing excess water reduces caving of cutbanks in shallow excavations in the Sickles soil. Capability subclass IIIw, Michigan soil management group 1c-4/1c.

Ve—Vestaburg loamy sand. This is a nearly level, poorly drained and very poorly drained soil in broad, flat areas and in drainageways. It is subject to frequent flooding. The areas are irregular in shape and are 2 to 600 acres in size.

Typically, the surface layer is very dark brown loamy sand about 8 inches thick. The substratum, to a depth of 25 inches, is gray, mottled sand. Below that, to a depth of 60 inches, it is grayish brown, calcareous gravelly sand.

Included with this soil in mapping are small areas of Gilford and Belleville soils in depressions and drainageways. These soils make up 1 to 8 percent of the mapped areas. They have a higher available water capacity than this Vestaburg soil. Also included are small areas of somewhat poorly drained Riverdale and Tedrow soils on low knolls and ridges; they make up 1 to 5 percent of the mapped areas.

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

This soil is mostly in native vegetation, including trees. In a few areas, it is used for crops or pasture. This soil has good potential for pasture. It has fair potential for crops and as habitat for wetland wildlife. It has poor potential for woodland.

If this soil is used for cultivated crops, removing excess water in wet periods, conserving soil moisture in dry periods, controlling soil blowing, and maintaining high organic-matter content are major management requirements. Artificial drainage can help remove excess water. Open ditches are difficult to maintain and tile is difficult to install, because the cutbanks cave in. Stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks are practices that help control soil blowing. Frequent additions of crop residue, manure, and green manure are needed to maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, excess water in wet periods and droughtiness in dry periods are major management problems. Artificial drainage can help remove excess water. Grazing is restricted in wet periods, and growth is reduced in dry periods.

If this soil is used for trees, windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are the major management problems. Because of wetness, seedling losses are high, and some trees blow down during storms. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders the natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches and tile drains. For local roads and streets to function properly, the surface layer of the Vestaburg soil should be covered with suitable base material. Removing excess water, constructing retaining walls, and maintaining the proper slope grade can prevent caving of cutbanks in shallow excavations. Capability subclass IIIw, Michigan soil management group 5c.

Wa—Wauseon sandy loam. This is a nearly level, very poorly drained soil in broad, flat areas and in drainageways. The areas are irregular in shape and 2 to 100 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 11 inches thick. The subsoil is gray, mottled, friable sandy loam about 21 inches thick. The substratum, to a depth of 60 inches, is gray, mottled, calcareous silty clay loam and silty clay.

Included with this soil in mapping are small areas of Lenawee, Sickles, and Lamson soils in broad, flat areas and in drainageways. These soils make up 2 to 10 percent of the mapped areas. The Lenawee soil has a higher available water capacity, and the Sickles soil has a lower available water capacity than this Wauseon soil. Also included are small areas of somewhat poorly drained Arkona and Pert soils on low knolls and ridges; they make up 1 to 5 percent of the mapped areas.

Permeability is rapid in the loamy upper part and very slow in the clayey lower part. The available water capacity is moderate. Runoff is very slow or ponded.

This soil is used mostly for crops. In a few areas, it is used for pasture, or it is in native vegetation, including trees. This soil has good potential for crops, pasture, and as habitat for woodland and wetland wildlife.

If this soil is used for cultivated crops, removing excess water is the major management problem. Artificial drainage helps increase crop yields.

If this soil is used for pasture, removing excess water is the major management problem. Restricted grazing in wet periods prevents compaction of the surface layer. Artificial drainage helps increase yields. Pasture plants that are more tolerant of wetness should be selected.

If this soil is used for trees, windthrow is the major hazard. Seedling mortality, equipment limitations, and plant competition are major management problems. Because of wetness, seedling losses are high, and trees may blow down during storms. The use of heavy equipment for planting and harvesting trees is restricted in wet periods. Sites must be intensively prepared and maintained because the growth of undesirable trees and shrubs hinders natural regeneration or restocking of desirable trees.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches and tile drains. Footings and foundations should be designed to prevent structural damage caused by frost action. For local roads and streets to function properly, the surface layer of the Wauseon soil should be replaced or covered with suitable base material. Capability subclass IIIw, Michigan soil management group 3/1c.

WxA—Wixom loamy sand, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on low knolls and ridges. It is subject to rare flooding. Slopes are slightly convex and are less than 50 feet long. The areas are irregular in shape and are 2 to 50 acres in size.

Typically, the surface layer is very dark gray loamy sand about 10 inches thick. The subsurface layer is light brownish gray sand about 6 inches thick. The subsoil is mottled, and it is about 26 inches thick. In sequence from the top, it is dark brown, loose sand, 8 inches thick; brownish yellow, loose sand 9 inches thick; light yellowish brown, very friable loamy sand 5 inches thick; and grayish brown, firm clay loam 4 inches thick. The substratum, to a depth of 60 inches, is grayish brown, calcareous clay loam with yellowish brown mottles.

Included with this soil in mapping are small areas of Dixboro and Capac soils, on low knolls and ridges. These soils make up 1 to 8 percent of the mapped areas. They have a higher available water capacity than this Wixom soil. Also included are small areas of poorly drained and very poorly drained Belleville, Parkhill, and Corunna soils in depressions; they make up 1 to 8 percent of the mapped areas.

Permeability is rapid in the sandy upper part and moderately slow in the loamy material. The available water capacity is low. Runoff is slow.

This soil is used mostly for crops or unimproved pasture. In a few areas, it is in native vegetation, including trees. This soil has fair potential for crops and woodland. It has good potential for pasture.

If this soil is used for cultivated crops, removing excess water in wet periods, controlling soil blowing, conserving moisture in dry periods, and maintaining high organic-matter content are major management requirements. Artificial drainage is needed to remove excess water. Stubble mulching and using minimum tillage, cover crops, buffer strips, and windbreaks are practices that help control soil blowing. Frequent additions of crop residue, manure, and green manure are needed to maintain content of organic matter. Crop residue and minimum tillage also conserve moisture. Legumes need additional applications of lime.

If this soil is used for pasture, excess water during wet periods in spring and droughtiness during dry summers are major management problems. Grazing is restricted in wet periods, and growth is reduced in dry periods.

If this soil is used for trees, potential productivity is medium. Seedling mortality is a moderate limitation because of the sandy surface layer.

This soil has severe limitations for most engineering uses. For such uses, it must be artificially drained by using surface ditches and tile drains. Removing excess water, constructing retaining walls, and maintaining the proper slope grade can prevent caving of cutbanks in shallow excavations. Capability subclass IIIw, Michigan soil management group 4/2b.

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 soils for crops and pasture, and woodland; as sites for buildings, highways, and other transportation systems; for sanitary facilities; for 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 and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, 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 influenced by the nature of the soil.

Crops and pasture

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 agricultural 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.

According to the U.S. Census of Agriculture, more than 300,000 acres in the survey area was used for crops and pasture in 1969. Of this total, 11,000 acres was used for permanent pasture; 155,000 acres was used for row crops, mainly dry beans; 25,000 acres was used for close-grown crops, mainly wheat and oats; 13,000 acres was used for hay crops; 7,000 acres was used for specialty crops, mainly sugar beets; and the rest was idle cropland.

Soil drainage is the major management requirement for about three-fourths of the acreage that is used for crops and pasture. Drainage of land used for crops improves the air-water relationship in the root zone. Spring planting, spraying, and harvesting are delayed and weed control is more difficult where drainage is poor. Properly designed tile drains or surface drainageways, or both, can be used to remove excess water (fig. 6). Some soils are naturally so wet that the production of crops common to the area generally is not possible. These are the poorly drained, or very poorly drained, or poorly drained and very poorly drained Cohoctah, Edwards, Sloan, and Saranac soils.

Unless artificial drainage is provided, very poorly drained, poorly drained, and somewhat poorly drained soils are so wet that crops are damaged during most years. Examples of these soils are Metamora, Belleville, Capac, Corunna, Wixom, Arkona, Selfridge, and Dixboro soils.

Perrinton, Marlette, and Huntington soils have good natural drainage most of the year, but they tend to become dry slowly after rain. Small areas of wetter soils along drainageways and in swales are commonly included in some areas of these soils, especially where slopes are 2 to 6 percent. Artificial drainage is needed in some of these wetter areas.

Spinks, Oakville, Plainfield, Arkport, and Boyer soils also have good natural drainage during most of the year. These soils become dry quickly and are deficient of moisture during dry summers. Early maturing crops can be grown if a large amount of organic material is added to the soils. Artificial drainage is needed in some of the wetter included areas.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and tile drainage is needed in most areas of poorly drained and very poorly drained soils that are used for intensive row cropping. Drains have to be more closely spaced in soils with slow permeability than in the more permeable soils. Tile drainage is slow or very slow in Toledo and Lenawee soils. Finding adequate outlets for tile drainage systems is difficult in many areas of Cohoctah, Adrian, Kingsville, Sloan, Houghton, and Ceresco soils. Diversions may be used in some areas to divert surface runoff from wet areas. Good soil structure and an ample supply of organic matter also benefit soil drainage. The low-lying areas are subject to a shortened growing season because of frost late in spring and early in fall.

Organic soils oxidize and subside when the pore space is filled with air; therefore, special drainage systems are needed to control the depth and the period of drainage. Maintaining the water table at the level required by crops during the growing season and raising it to the surface during other times of the year minimize the oxidation and subsidence of organic soils. Information on drainage design for each kind of soil is contained in the Technical Guide in local offices of the Soil Conservation Service.

Soil erosion, including soil blowing, is the major hazard on about one-half of the cropland in Gratiot County. If the slope is more than 2 percent, water erosion is a hazard. Marlette and Perrinton soils, for example, have slopes of 2 to 12 percent.

Loss of the surface layer by erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as the Perrinton soils. Erosion also reduces productivity on soils that tend to be droughty, such as Arkport and Boyer soils. Second, soil erosion on farmland results in sediment entering streams. Controlling erosion minimizes stream pollution caused by sediment, and it improves the quality of water for municipal and recreational use, for fish, and for wildlife habitat.

In many sloping areas, preparing a good seedbed and tilling are difficult on clayey spots because the original friable surface layer has been eroded. Such spots are common in the sloping areas of Marlette and Perrinton soils.

Erosion-control practices provide a protective cover for the surface layer, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can keep erosion losses to a minimum so that production by the soils will not be reduced. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land and provide nitrogen and improve tilth for the following crop.

Terraces and diversions reduce runoff, erosion, and the length of slope. They are most practical on deep, well drained soils that have regular slopes. However, most soils in Gratiot County generally are not suitable for terracing and diversions, because of irregular slopes, excessive wetness in the terrace channels, a clayey subsoil which would be exposed in terrace channels, or excessive droughtiness.

Contouring and stripcropping are also useful erosion-control practices. They are best adapted to soils that have smooth, uniform slopes, including a few areas of the sloping Marlette and Perrinton soils. In most areas, the slopes are too short and too irregular.

Soil blowing is a hazard on the sandy Oakville, Boyer, Selfridge, Wixom, Arkona, Tedrow, Pipestone, Spinks, Arkport, Dixboro, and Plainfield soils and on the mucky Houghton, Edwards, Palms, Olentangy, Thomas, and Adrian soils. It can damage these soils, especially the muck soils, in a few hours if winds are strong and if the soils are dry and the surface layer is bare of vegetation or mulch. On the sandy soils, maintaining a vegetative cover (fig. 7), no tillage, surface mulch, buffer strips of grain 2 or 3 feet apart, or rough surfaces by using proper tillage minimize soil blowing. Overgrazing results in blowouts or other severe erosion effects.

Slopes are so short and irregular that contour tillage or terracing is not practical in most areas of the sloping Marlette, Perrinton, or Spinks soils. On these soils, cropping systems that provide substantial vegetative cover are required to control erosion, unless minimum tillage is practiced. Minimizing tillage and leaving crop residue on the surface help to increase infiltration and reduce runoff and erosion. These practices are suitable for Marlette, Perrinton, and Spinks soils. Grassed waterways can also be used to help control erosion (fig. 8).

Nontillage for corn, which is common on an increasing acreage, is effective in reducing erosion on sloping land and can be adapted to some of the soils in the survey area. However, it is more difficult to practice nontillage successfully on soils that have a clayey surface layer. Nontillage leaves residue of previous crops on the soil as a mulch which reduces soil blowing and water erosion. This allows high yields of corn in areas that were previously considered marginal, because of erosion.

Good management is necessary for satisfactory crop production with any tillage system. Nontillage requires learning new skills in planting and in insect and weed control. Proper time for planting, selection of herbicides that are suited to the vegetation present, control of insect pests, adequate nutrients, and selection of tillage systems based on soil characteristics are important management requirements.

On muck soils, windbreaks of such adapted shrubs as Tatarian honeysuckle or silky dogwood are effective in reducing soil blowing. Sprinkler irrigation, control of the water table, and use of buffer strips of grain that are 2 to 3 feet apart are also effective in minimizing soil blowing.

Information for designing erosion-control practices for each kind of soil is in the Technical Guide in local offices of the Soil Conservation Service.

Soil fertility is naturally medium to high for loamy soils and low in most sandy soils on the uplands. The soils on flood plains, such as Cohoctah, Saranac, Sloan, and Ceresco soils, range from slightly acid to mildly alkaline and are naturally higher in plant nutrients than most soils on the uplands.

Many sandy soils are naturally strongly acid to slightly acid, and if lime has never been applied, they require applications of ground limestone to raise the pH level sufficiently for good growth of alfalfa and other crops that grow only on almost neutral soils. Available phosphorus and potash levels are naturally low to medium in most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply (*4*).

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

Some of the soils that are used for crops have a loamy surface layer that is light colored and has low organic-matter content. Generally, the structure of such soils is weak, and intense rainfall causes the formation of crust on the surface layer. When the crust forms, infiltration is reduced and runoff is increased. Regular additions of crop residue, manure, and other organic material can help improve soil structure and reduce crust formation.

The dark colored Toledo, Saranac, and Lenawee soils are clayey, and tilth is a problem on these soils because they often stay wet until late in spring. If these soils are wet when plowed, they tend to be very cloddy when dry, the subsoil compacts and good seedbeds are difficult to prepare. The growing of cover and green manure crops, proper use of crop residue, minimum tillage, and the application of livestock manure help maintain and improve organic-matter content and tilth. Fall plowing at the proper moisture content, on nearly level, poorly drained or somewhat poorly drained soils can reduce tilth damage and allow tillage earlier in the following spring. Fall plowing should not be done on sloping land or on soils that are subject to soil blowing. Grazing on loamy and clayey soils when they are wet should be avoided because it results in compaction of the soil and in poor tilth. Good practices are needed most if there is an intensive cropping system or continuous cultivation.

Field crops suited to the soils and climate of the survey area include a few that presently are not commonly grown. Corn, field beans, and soybeans are the row crops commonly grown in the survey area. Grain sorghum, sunflowers, potatoes, and similar crops can be grown if economic conditions are favorable.

Wheat and oats are the common close-growing crops. Rye, barley, buckwheat, and flax could be grown, and grass seed could be produced from bromegrass, fescue, redtop, and bluegrass.

Specialty crops grown commercially in the survey area are cucumbers and sugar beets. A small acreage is used for potatoes, strawberries, sweet corn, tomatoes, cabbage, other vegetables, and small fruits. In addition, large areas could be adapted to other specialty crops such as blueberries, grapes, tree fruits, and many vegetables.

Deep soils that have good natural drainage and that warm early in spring are especially well suited to many vegetables and small fruits. These are Arkport, Boyer, Spinks, and Metea soils where slopes are less than 6 percent. Also, if they are irrigated, Oakville and Plainfield soils that have slopes of less than 6 percent are very well suited to vegetables and small fruits. Crops generally can be planted and harvested earlier on all these soils than on the other soils in the survey area.

If adequate drainage and adequate protection from soil blowing are provided, the muck soils are well suited to sod and to a wide range of vegetable crops. Houghton, Edwards, Palms, and Adrian muck soils are most suitable for these crops.

Most of the well drained soils in the survey area are suitable for orchards and nursery plants. However, soils in low areas where frost action is frequent and air drainage is poor generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for growing specialty 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 grasses and 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 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 (*7*). The soils are classed according to their limitations 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 rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at two levels: capability class and subclass. These levels 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, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 6. All map units in the survey area except Pits, Aquents-Udorthents complex, and other miscellaneous areas 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 is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Woodland management and productivity

Table 7 contains information useful to woodland owners or forest managers planning use of soils for wood crops. The soils suitable for wood crops are listed alphabetically followed by the map unit symbols.

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.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *important 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, depth to bedrock, 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. Where 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 gravel, 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 scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be 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. Table 12 specifies the kind of limitations 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 basements, small commercial buildings, and local roads and streets are indicated in table 9. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is 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 rated severe, such 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, or large stones. 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 or extremely 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, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonally high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Slope and large stones in or on the soil are also important considerations in the choice of sites for these structures and were 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 content of large stones affect stability and ease of excavation.

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,* and *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 72 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. Stones interfere with installation. 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 and gravel are 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 or stones 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. 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 or gravelly 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.

If 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 material. Each soil is evaluated to the depth observed, generally about 6 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, low frost action 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, wetness, or many stones. 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. Fine-grained soils are not suitable sources of sand and gravel.

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 soluble salts or 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 or soils that have appreciable amounts of gravel or stones.

Soils rated *poor* are very sandy soils or very firm clayey soils; soils that have suitable layers less than 8 inches thick; soils that have large amounts of gravel or stones; steep soils; 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 the 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.

Pond reservoir areas hold water behind a dam or embankment (fig. 9). Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to permeable material.

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. Large stones and organic matter in a soil downgrade 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; depth to 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.

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 or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

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 or boulders 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 or boulders, is firm after rains, and is not dusty when dry.

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 or boulders on the surface.

Wildlife habitat

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 habitat 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, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

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, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bluegrass, bromegrass, clover, and alfalfa.

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, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are wild oats, goldenrod, ragweed, and dandelion.

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 hardwood plants are oak, poplar, maple, beech, hawthorn, dogwood, hickory, grapes, and briers. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are autumn-olive and Amur or Tatarian honeysuckle.

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, balsam fir, white-cedar, juniper, and larch.

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, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, and bulrushes, sedges, and reeds.

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, surface stoniness, 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 quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

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 owls, ruffed grouse, woodcock, thrushes, nuthatches, woodpeckers, squirrels, raccoon, deer, and opossum.

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, 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, and gravel or other 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 (*6*). 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 classfies 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. The estimated classification 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 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 in plasticity index is 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.

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.

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.

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 very gravelly or sandy soils are the least susceptible.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*8*). 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 Alfisol.

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 Udalfs.

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 Hapludalfs.

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 Hapludalfs.

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 coarse-loamy, mixed, mesic Typic Hapludalfs.

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 (*6*). 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."

Adrian series

The Adrian series consists of very poorly drained soils on lowlands and flood plains. The soils formed in organic sediment deposited in open water. They are underlain at a depth of 16 to 50 inches by calcareous sand. Permeability is moderately slow to moderately rapid in the organic material and rapid in the underlying sand. Slope ranges from 0 to 1 percent.

Adrian soils are commonly adjacent to Kingsville and Edwards soils on lowlands and flood plains. Unlike Adrian soils, Kingsville soils lack an organic horizon, and the organic horizon in Edwards soils is underlain by marl rather than sand.

Typical pedon of Adrian muck, 2,380 feet north and 100 feet east of the southwest corner of sec. 16, T. 9 N., R. 1 W.

Oa1—0 to 16 inches; black (10YR 2/1) broken face sapric material, black (N 2/0) rubbed; about 12 percent fiber, less than 5 percent when rubbed; moderate medium granular structure; friable; primarily herbaceous fibers; neutral; abrupt wavy boundary.

Oa2—16 to 20 inches; black (10YR 2/1) broken face sapric material, very dark brown (10YR 2/2) rubbed; about 15 percent fiber, less than 5 percent when rubbed; weak coarse subangular blocky structure; friable; primarily herbaceous fibers; slightly acid; gradual wavy boundary.

Oa3—20 to 27 inches; black (10YR 2/1) broken face and rubbed sapric material; about 12 percent fiber, less than 5 percent when rubbed; massive; friable; primarily herbaceous fibers; medium acid; abrupt smooth boundary.

Oa4—27 to 34 inches; black (10YR 2/1) broken face and rubbed sapric material; about 12 percent fiber, less than 5 percent when rubbed; massive; friable; primarily herbaceous fibers; about 20 percent ash; slightly acid; abrupt smooth boundary.

IICg—34 to 60 inches; gray (10YR 5/1) sand that has common medium distinct light olive brown (2.5Y 5/4) mottles; single grained; loose; 13 percent pebbles; strong effervescence; moderately alkaline.

The organic material ranges from 16 to 50 inches in thickness, but typically it is 16 to 43 inches thick. It consists primarily of sapric material. In a few pedons there is a thin layer of hemic material less than 10 inches thick. The organic material below the Oa1 horizon is medium acid to mildly alkaline, but it typically is slightly acid to neutral. The composition of the fibers is about 90 percent herbaceous, and there are a few woody fragments throughout the organic material in some pedons. The O1 horizon has hue of 7.5YR or 10YR or is neutral; it has value of 2 to 4 and chroma of 0 to 3. The color of broken face material and of rubbed material is generally similar but can vary one or two units in value or in chroma, or in both. Mineral content in the Oa4 horizon is as much as 50 percent by volume.

The IIC horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is sand, gravelly sand, or gravelly coarse sand. Coarse fragments make up as much as 40 percent, by volume, of this horizon.

Arkona series

The Arkona series consists of somewhat poorly drained soils on uplands. The soils formed in sandy material. They are underlain at a depth of 20 to 40 inches by clayey material. Permeability is rapid in the sandy material and slow in the underlying clayey material. Slope ranges from 0 to 2 percent.

Arkona soils are similar to Sickles and Wixom soils. Sickles soils are gray rather than brown below the A horizon and generally are in a lower position on the landscape than Arkona soils. Wixom soils are coarser textured in the IIBtg and IICg horizons than Arkona soils and are in a similar position on the landscape.

Typical pedon of Arkona loamy sand, 1,620 feet west and 50 feet south of the northeast corner of sec. 13, T. 9 N., R. 2 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy sand; weak fine granular structure; very friable; slightly acid; abrupt smooth boundary.

A2—10 to 12 inches; light grayish brown (10YR 6/2) sand; single grained; loose; few roots; slightly acid; abrupt irregular boundary.

B21ir—12 to 15 inches; dark brown (7.5YR 4/4) sand that has few fine faint yellowish brown (10YR 5/6) mottles; single grained; loose; many reddish brown (5YR 4/4) small fragments of cemented material; slightly acid; gradual broken boundary.

B22ir—15 to 21 inches; brownish yellow (10YR 6/6) sand that has common fine and medium distinct grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; slightly acid; clear wavy boundary.

A'2—21 to 35 inches; pale brown (10YR 6/3) sand that has many fine faint grayish brown (10YR 5/2) and few fine faint yellowish brown (10YR 5/6) mottles; single grained; loose; neutral; clear wavy boundary.

IIB'2tg—35 to 41 inches; light grayish brown (10YR 6/2) silty clay that has common medium distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; very firm; 2 percent pebbles; mildly alkaline; abrupt irregular boundary.

IICg—41 to 60 inches; grayish brown (10YR 5/2) silty clay that has common medium distinct yellowish brown (10YR 5/6) and light yellowish brown (10YR 6/4) mottles; massive; very firm; 2 percent pebbles; slight effervescence; mildly alkaline.

The depth to the IIB'2tg horizon ranges from 20 to 40 inches, but it typically is 24 to 37 inches. Reaction typically is medium acid to neutral in the sandy part of the solum and neutral to mildly alkaline in the IIB'2tg horizon.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is absent in some places and is often discontinuous.

The B21ir horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 6, and chroma of 2 to 6. A few weakly to strongly cemented fragments are in some pedons. The B22ir horizon has hue of 10YR, value of 5 or 6, and chroma of 3, 4, or 6.

The A'2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is sand, loamy fine sand, or loamy sand. Some pedons do not have an A'2 horizon.

The IIB'2tg horizon has hue of 10YR, value of 5 or 6, and chroma of 2. It is silty clay or clay.

The IICg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is silty clay or clay that has bands of heavy silty clay loam.

Arkport series

The Arkport series consists of well drained soils on uplands. The soils formed in calcareous, stratified sandy and loamy material. Permeability is moderately rapid. Slope ranges from 1 to 12 percent.

Arkport soils are similar to Spinks soils and are commonly adjacent to Spinks and Metea soils. Spinks soils are coarser textured in the B horizon and generally are in a higher position on the landscape than Arkport soils. Unlike Arkport soils, Metea soils lack stratification in the B horizon, are finer textured in the B and C horizons than Arkport soils, and are in a similar position on the landscape.

Typical pedon of Arkport loamy fine sand, 1 to 6 percent slopes, 1,665 feet north and 60 feet west of the southeast corner of sec. 29, T. 12 N., R. 4 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy fine sand; moderate medium granular structure; very friable; few roots; neutral; abrupt smooth boundary.

A2—9 to 22 inches; yellowish brown (10YR 5/6) loamy fine sand; weak fine subangular blocky structure; very friable; few roots; 3 percent pebbles; slightly acid; clear irregular boundary.

B&A—22 to 30 inches; stratified dark yellowish brown (10YR 4/4) loam (B2t) and light gray (10YR 7/2) loamy fine sand (A2); weak fine and coarse subangular blocky structure; very friable (A2) and friable (B2t); few thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; 3 percent pebbles; very few fine roots; neutral; gradual wavy boundary.

IIC1—30 to 42 inches; very pale brown (10YR 7/4) and yellowish brown (10YR 5/4) stratified loamy very fine sand, very fine sand, and very fine sandy loam; massive; very friable; very few fine roots; slight effervescence; mildly alkaline; gradual wavy boundary.

IIC2—42 to 53 inches; dark yellowish brown (10YR 4/4) and brownish yellow (10YR 6/6) stratified loamy fine sand and fine sandy loam; massive; very friable; 2 percent pebbles; slight effervescence; mildly alkaline; gradual wavy boundary.

IIC3—53 to 60 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) stratified loamy sand and sandy loam; massive; very friable; 3 percent pebbles; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates are 24 to 40 inches. Reaction of the solum typically is medium acid to neutral.

The A1 or Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. It is dominantly loamy fine sand, but in some places it is loamy sand and fine sandy loam.

The B part of the B&A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is fine sandy loam, loam, or silt loam and is 11 to 18 percent clay.

The C horizon has hue of 10YR, value of 4 to 7, and chroma of 4, 6, or 8. It is stratified loamy fine sand, loamy very fine sand, very fine sandy loam, fine sandy loam, sandy loam, or loamy sand.

The solum in Arkport soils typically is thinner than the range defined for the Arkport series, but this difference does not alter the use or behavior of the soils.

Belleville series

The Belleville series consists of poorly drained and very poorly drained soils on lowlands. The soils formed in sandy material. They are underlain at a depth of 20 to 40 inches by calcareous loamy glacial till. Permeability is rapid in the sandy material and moderately slow in the underlying loamy till. Slope ranges from 0 to 2 percent.

Belleville soils are commonly adjacent to Corunna and Parkhill soils in most places. Corunna and Parkhill soils have a B horizon and are finer textured in the upper part of the profile than Belleville soils and are in a similar position on the landscape.

Typical pedon of Belleville loamy sand, 1,020 feet east and 75 feet south of the northwest corner of sec. 1, T. 12 N., R. 2 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loamy sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

C1g—8 to 30 inches; dark gray (10YR 4/1) loamy sand; weak fine subangular blocky structure; very friable; neutral; clear wavy boundary.

C2g—30 to 35 inches; gray (10YR 5/1) loamy sand; weak fine subangular blocky structure; friable; 5 percent pebbles; mildly alkaline; abrupt wavy boundary.

IIC3g—35 to 60 inches; gray (10YR 5/1) clay loam that has few medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; 3 percent pebbles; slight effervescence; moderately alkaline.

The depth to the IIC3g horizon is 20 to 40 inches. Reaction ranges from slightly acid to neutral in the Ap and C1g horizons and to mildly alkaline in the C2g horizon.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is 7 to 10 inches thick. It is dominantly loamy sand, but in places it is sand, fine sand, and loamy fine sand. The Cg horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is sand, fine sand, loamy sand, or loamy fine sand.

The IICg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is loam, silt loam, clay loam, or silty clay loam.

The solum in Belleville soils typically is thinner and darker colored than the range defined for the Belleville series, but this difference does not alter the use or behavior of the soils.

Boyer series

The Boyer series consists of well drained soils on uplands. The soils formed in sandy and loamy material. They are underlain at a depth of 24 to 40 inches by calcareous gravelly sand. Permeability is moderately rapid. Slope ranges from 0 to 6 percent.

Boyer soils are commonly adjacent to Plainfield or Spinks soils in most places. Plainfield soils are coarser textured in the B horizon than Boyer soils and are in a similar position on the landscape. Spinks soils are coarser textured in the B horizon than Boyer soils. They are in a similar position on the landscape.

Typical pedon of Boyer loamy sand, 0 to 6 percent slopes, 1,330 feet east and 50 feet south of the northwest corner of sec. 4, T. 10 N., R. 4 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loamy sand; weak fine granular structure; very friable; 12 percent pebbles; few fibrous roots; neutral; abrupt smooth boundary.

A2—8 to 14 inches; yellowish brown (10YR 5/6) loamy sand; weak fine subangular blocky structure; very friable; 8 percent pebbles; neutral; clear wavy boundary.

B1—14 to 18 inches; yellowish brown (10YR 5/4) loamy sand; weak fine subangular blocky structure; very friable; 8 percent pebbles; neutral; gradual wavy boundary.

B2t—18 to 24 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; common thin clay films; 10 percent pebbles; mildly alkaline; abrupt irregular boundary.

IIC—24 to 60 inches; brown (10YR 5/3) gravelly sand; single grained; loose; 25 percent pebbles; 3 percent cobbles; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to the IIC horizon are 22 to 40 inches. Reaction is medium acid to neutral in the A and B1 horizons and slightly acid to mildly alkaline in the B2t horizon. The solum contains 1 to 20 percent pebbles, and the IIC horizon contains 10 to 30 percent pebbles and 1 to 5 percent cobbles.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 or 6. It is sandy loam, gravelly sandy loam, or light sandy clay loam.

The IIC horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is gravelly sand, coarse sand, or stratified sand and gravel.

Capac series

The Capac series consists of somewhat poorly drained soils on uplands. The soils formed in calcareous, loamy glacial till. Permeability is moderate and moderately slow. Slope ranges from 0 to 3 percent.

Capac soils commonly are adjacent to Metamora and Selfridge soils. Metamora soils are coarser textured in the upper part of the B horizon than Capac soils and are in a similar position on the landscape. Selfridge soils are coarser textured in the A and B horizons than Capac soils and are in a similar position on the landscape.

Typical pedon of Capac loam, 0 to 3 percent slopes, 1,420 feet south and 60 feet west of the northeast corner of sec. 31, T. 11 N., R. 2 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; 7 percent pebbles; neutral; abrupt smooth boundary.

B&A—8 to 13 inches; yellowish brown (10YR 5/4) clay loam (Bt) that has many medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; grayish brown (10YR 5/2) silt coatings (A2) approximately 2 millimeters thick on vertical faces of peds; 2 percent pebbles; neutral; gradual wavy boundary.

B21t—13 to 20 inches; light yellowish brown (10YR 6/4) clay loam that has many medium distinct yellowish brown (10YR 5/8) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; continuous thin dark grayish brown (10YR 4/2) clay films on faces of peds; 2 percent pebbles; gradual wavy boundary.

B22t—20 to 28 inches; brown (10YR 5/3) clay loam that has many medium distinct yellowish brown (10YR 5/6) and common fine and medium faint light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; 3 percent pebbles; neutral; gradual wavy boundary.

Cg—28 to 60 inches; grayish brown (10YR 5/2) loam that has many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; 4 percent pebbles; slight effervescence; moderately alkaline.

The solum is 26 to 40 inches thick. The content of pebbles ranges from 0 to 10 percent throughout. Reaction in the solum is medium acid to neutral.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. It is loam or sandy loam. In some places, a thin A2 horizon is immediately below the Ap horizon. Where present, the A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2.

Coatings of material from the A2 horizon are 1 to 5 millimeters thick on the faces of peds in the upper part of the B&A horizon.

The B part of the B&A horizon has hue of 10YR, value of 5 or 6, and chroma of 3, 4, or 6. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is clay loam, silty clay loam, or loam.

The Cg horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is loam or clay loam.

Capac Variant

The Capac Variant consists of somewhat poorly drained soils on uplands. These soils formed in loamy material containing numerous cobbles. They are underlain at a depth of 26 to 37 inches by calcareous loamy till. Permeability is moderate or moderately slow. Slope ranges from 0 to 2 percent.

Capac Variant soils are commonly adjacent to Metea Variant soils. Metea Variant soils are coarser textured in the A and B horizons than Capac Variant soils and lack gray mottles in the B horizon, which Capac Variant soils have. They are on ridges in a higher position on the landscape than Capac Variant soils.

Typical pedon of Capac Variant cobbly sandy loam in an area of Capac Variant-Parkhill complex, 0 to 2 percent slopes, 2,050 feet east and 1,176 feet north of the southwest corner of sec. 26, T. 9 N., R. 3 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) cobbly sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; 45 percent cobbles; 10 percent pebbles; neutral; abrupt smooth boundary.

A2—8 to 14 inches; brown (10YR 5/3) cobbly sandy loam that has few medium distinct yellowish brown (10YR 5/6) and few medium faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; 37 percent cobbles; 12 percent pebbles; neutral; clear wavy boundary.

B2t—14 to 25 inches; brown (10YR 5/3) cobbly clay loam that has common fine faint grayish brown (10YR 5/2) and few fine faint dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; 35 percent cobbles; 10 percent pebbles; few thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; abrupt wavy boundary.

C—25 to 60 inches; brown (10YR 5/3) loam that has common medium faint grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; 12 percent pebbles; slight effervescence; moderately alkaline.

The solum is 25 to 40 inches thick. The content of cobbles ranges from 15 to 60 percent and the content of gravel ranges from 10 to 30 percent throughout the solum. Reaction in the Ap and A2 horizons and in the upper part of the B2t horizon ranges from slightly acid to neutral. The lower part of the B2t horizon is slightly acid to mildly alkaline.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. The A horizon is dominantly cobbly sandy loam and cobbly loam, but in places it is gravelly analogs of these textures.

The B2t horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is cobbly clay loam, cobbly silty clay loam, or cobbly loam, and in a few places it is gravelly analogs of these textures.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is loam or clay loam, and in a few places it is gravelly analogs of these textures.

Ceresco series

The Ceresco series consists of somewhat poorly drained soils on flood plains. The soils formed in loamy alluvial material. They are underlain below 30 inches by sandy and gravelly alluvial material. Permeability is moderate or moderately rapid. Slope ranges from 0 to 2 percent.

Ceresco soils are similar to Cohoctah and Riverdale soils. Cohoctah soils are poorly drained and very poorly drained and are in a slightly lower position on the landscape than Ceresco soils. Riverdale soils are coarser textured in the A and B horizons and lack an organic-matter content that decreases irregularly with depth. Riverdale soils are on uplands adjacent to the flood plains and on nearby outwash plains.

Typical pedon of Ceresco fine sandy loam, gravelly substratum, 2,541 feet south and 2,480 feet east of the northwest corner of sec. 18, T. 12 N., R. 2 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; few fibrous roots; neutral; abrupt smooth boundary.

B1—11 to 26 inches; yellowish brown (10YR 5/4) fine sandy loam that has common medium distinct light brownish gray (10YR 6/2) and few fine distinct yellowish brown (10YR 4/4) mottles; moderate medium granular structure; very friable; neutral; clear wavy boundary.

B2—26 to 32 inches; brown (10YR 5/3) loamy fine sand that has common medium faint light brownish gray (10YR 6/2) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium granular structure; very friable; thin discontinuous strata of black (10YR 2/1) organic material; mildly alkaline; gradual wavy boundary.

C1g—32 to 38 inches; grayish brown (10YR 5/2) sandy loam that has common medium distinct yellowish brown (10YR 5/6) mottles; weak medium granular structure; very friable; few thin strata of black (10YR 2/1) organic material; slight effervescence; mildly alkaline.

IIC2g—38 to 60 inches; grayish brown (10YR 5/2) gravelly sand that has few coarse distinct yellowish brown (10YR 5/6) mottles; single grained; loose; 20 percent pebbles; strong effervescence; moderately alkaline.

The solum is 24 to 35 inches thick. The depth to the IICg horizon is 30 to 45 inches. Reaction is slightly acid to mildly alkaline throughout. In many pedons, the B2 and C1g horizons have thin layers that contain a greater amount of organic matter. These layers have hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

Where present, the Ap or A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is 10 to 13 inches thick. It is dominantly fine sandy loam, but in places it is sandy loam or loam.

The B1 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. The B horizon is fine sandy loam, sandy loam with thin layers of loamy fine sand, or loamy fine sand.

The Cg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. The C1g horizon has thin strata of silt loam, 1/2 to 1 inch thick, in some places. It is sandy loam or loamy fine sand.

The IIC2g horizon is gravelly sand, sand, or stratified sand and gravel.

Cohoctah series

The Cohoctah series consists of poorly drained and very poorly drained soils on flood plains. The soils formed in loamy material. They are underlain at a depth of 30 to 45 inches by sandy and gravelly alluvial material. Permeability is moderately rapid. Slope is 0 to 1 percent.

Cohoctah soils are similar to Ceresco, Gilford, and Sloan soils. Ceresco soils are brown below the A horizon and are in a slightly higher position on the landscape than Cohoctah soils. Unlike Cohoctah soils, Gilford soils lack an organic-matter content that decreases irregularly with depth. Gilford soils are in narrow drainageways and depressions that are adjacent to flood plains. Sloan soils are finer textured in the B and C horizons than Cohoctah soils and are in a similar position on the landscape.

Typical pedon of Cohoctah fine sandy loam, gravelly substratum, in an area of Cohoctah-Ceresco fine sandy loams, gravelly substratum, 1,250 feet east and 60 feet north of southwest corner of sec. 6, T. 11 N., R. 4 W.

A1—0 to 12 inches; very dark grayish brown (10YR 3/2) fine sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; neutral; abrupt wavy boundary.

C1g—12 to 17 inches; dark gray (10YR 4/1) fine sandy loam that has few fine distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

C2g—17 to 32 inches; gray (10YR 5/1) sandy loam that has many fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; neutral; gradual wavy boundary.

C3g—32 to 37 inches; very dark brown (10YR 2/2) sandy loam; massive; friable; mildly alkaline; gradual irregular boundary.

IIC4g—37 to 45 inches; gray (10YR 5/1) sand that has few moderate distinct yellowish brown (10YR 5/6) mottles; single grained; loose; 3 percent pebbles; slight effervescence; moderately alkaline; clear wavy boundary.

IIC5g—45 to 60 inches; gray (10YR 5/1) gravelly coarse sand; single grained; loose; 25 percent pebbles; 1 percent cobbles; strong effervescence; moderately alkaline.

The depth to the IICg horizon is 30 to 45 inches. Reaction is slightly acid to mildly alkaline in the Ap, A1, and Cg horizons.

The A1 or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly fine sandy loam, but in places it is sandy loam, loam, or loamy sand. It is 10 to 18 inches thick.

The Cg horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 or 2. Layers that contain a greater amount of organic matter have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The C1g or C2g horizons are sandy loam or fine sandy loam. Some pedons have thin strata of sand, loamy sand, or loamy fine sand. The C3g horizon is loamy sand or sandy loam.

The IICg horizon is sand, gravelly sand, gravelly coarse sand, or stratified sand and gravel. In a few places, the IIC5g horizon is fine sand and very fine sand.

Corunna series

The Corunna series consists of poorly drained and very poorly drained soils on lowlands. The soils formed in loamy glacial till. Permeability is moderate or moderately rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 1 percent.

Corunna soils are similar to Wauseon soils and are commonly adjacent to Belleville or Lamson soils in most places. Belleville soils are coarser textured in the upper part of the profile than Corunna soils, do not have a B horizon, and are in a similar position on the landscape. Lamson soils are coarser textured in the C horizon than Corunna soils and are in a similar position on the landscape. Wauseon soils are finer textured in the IIC horizon than Corunna soils and are also in a similar position on the landscape.

Typical pedon of Corunna sandy loam, 1,220 feet east and 75 feet north of the southwest corner of sec. 21, T. 12 N., R. 2 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; weak medium granular; friable; neutral; abrupt smooth boundary.

B21g—9 to 15 inches; gray (10YR 5/1) sandy loam that has few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

B22g—15 to 31 inches; gray (10YR 5/1) sandy loam that has common medium distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; friable; 10 percent pebbles; neutral; gradual wavy boundary.

IIC1g—31 to 34 inches; gray (10YR 5/1) loam that has few medium distinct brownish yellow (10YR 6/6) mottles; massive; friable; 3 percent pebbles; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC2g—34 to 60 inches; gray (10YR 5/1) clay loam that has common medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; massive; firm; 5 percent pebbles; slight effervescence; moderately alkaline.

The solum is 26 to 40 inches thick, and the depth to the IIC horizon is generally the same. Reaction of the solum is slightly acid to mildly alkaline throughout.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The B2g horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is sandy loam, fine sandy loam, or heavy sandy loam.

The IICg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is loam, clay loam, or silty clay loam.

The solum in Corunna soils typically is thinner and darker colored than the range defined for the Corunna series, but this difference does not alter the use or behavior of the soils.

Dixboro series

The Dixboro series consists of poorly drained soils on uplands. The soils formed in stratified loamy material. Permeability is moderate or moderately rapid. Slope ranges from 0 to 3 percent.

Dixboro soils are similar to Metamora soils and are adjacent to them in some places. Metamora soils are finer textured in the C horizon than Dixboro soils and are in a similar position on the landscape. Dixboro soils are commonly adjacent to Lamson soils on uplands. Lamson soils are gray in the B horizon and are in a lower position on the landscape than Dixboro soils.

Typical pedon of Dixboro fine sandy loam, 0 to 3 percent slopes, 1,970 feet north and 60 feet east of the southwest corner of sec. 4, T. 11 N., R. 4 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

A2—9 to 15 inches; pale brown (10YR 6/3) fine sandy loam that has few fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; few roots; neutral; gradual wavy boundary.

B&A—15 to 29 inches; stratified yellowish brown (10YR 5/4) loam (B21t) that has common medium distinct grayish brown (10YR 5/2) and few fine faint yellowish brown (10YR 5/8) mottles, and pale brown (10YR 6/3) fine sandy loam (A2); weak medium subangular blocky structure; friable; few thin discontinuous dark brown (10YR 3/3) clay films; few roots; neutral; clear wavy boundary.

B22t—29 to 38 inches; light yellowish brown (10YR 6/4) loam and thin lenses of loamy very fine sand and very fine sandy loam that have common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; common fine discontinuous dark brown (10YR 3/3) clay films; mildly alkaline; abrupt wavy boundary.

Cg—38 to 60 inches; grayish brown (10YR 5/2) stratified fine sandy loam, loamy fine sand, and silt loam that has common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; strong effervescence; mildly alkaline.

The solum is 24 to 44 inches thick. Reaction is slightly acid to neutral in the A and B&A horizons and neutral to mildly alkaline in the B22t horizon.

The A1 or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is dominantly fine sandy loam, but in places it is loamy very fine sand, very fine sandy loam, or loamy fine sand.

The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is loamy very fine sand, fine sandy loam, or very fine sandy loam.

The B part of the B&A horizon is dominantly light loam, heavy fine sandy loam, very fine sandy loam, or silt loam. The A part is fine sandy loam, loamy very fine sand, or heavy loamy fine sand.

The B horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. In some places, the B&A horizon is absent, or the B horizon is continuous. Also, there are thin, discontinuous strata of silt loam or silty clay loam in some pedons.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is stratified very fine sand, fine sandy loam, loamy fine sand, light silt loam, and silt and has thin, discontinuous strata of silt loam, very fine sandy loam, or silty clay loam in some places.

Edwards series

The Edwards series consists of very poorly drained soils on lowlands. The soils formed in organic material deposited in open water. They are underlain by marl. Permeability is moderately slow to moderately rapid in the organic material and variable in the underlying marl. Slope ranges from 0 to 1 percent.

Edwards soils are adjacent to Martisco and Adrian soils in most places. Martisco soils have organic material that is less than 16 inches thick and are in a similar position on the landscape. Adrian soils are underlain by sand rather than marl.

Typical pedon of Edwards muck, 1,640 feet west and 350 feet north of the southeast corner of sec. 33, T. 11 N., R. 4 W.

Oa1—0 to 6 inches; black (N 2/0) broken face and rubbed sapric material; about 5 percent fiber, less than 5 percent when rubbed; moderate fine granular structure; friable; herbaceous fibers; neutral; abrupt wavy boundary.

Oa2—6 to 26 inches; very dark brown (10YR 2/2) broken face sapric material, black (10YR 2/1) rubbed; about 5 percent fiber, less than 5 percent when rubbed; moderate medium granular structure; friable; herbaceous fibers with few woody fragments; neutral; gradual wavy boundary.

Oa3—26 to 35 inches; black (N 2/0) broken face and rubbed sapric material; about 5 percent fiber, less than 5 percent when rubbed; weak fine granular structure; friable; herbaceous fibers; neutral; abrupt smooth boundary.

Lca1—35 to 40 inches; white (10YR 8/1) marl that has few fine faint pink (10YR 8/4) mottles and very dark gray (10YR 3/1) organic material along root channels; massive; friable; strong effervescence; moderately alkaline; gradual wavy boundary.

Lca2—40 to 60 inches; gray (10YR 6/1) marl; massive; friable; strong effervescence; moderately alkaline.

The organic material ranges from 16 to 50 inches in thickness, but typically it is 16 to 43 inches thick. It is primarily sapric material, and the fibers are primarily herbaceous. Reaction in the Oa horizon is slightly acid to mildly alkaline. In some places, the Oa3 horizon contains free carbonates. Also, snail shells commonly are present.

The Oa horizon has hue of 7.5YR or 10YR or is neutral; value of 2 or 3, and chroma of 0 to 3.

The Lca horizon has hue of 10YR, value of 5 to 8, and chroma of 1 or 2. It is mildly alkaline or moderately alkaline.

Gilford series

The Gilford series consists of very poorly drained soils on lowlands. The soils formed in loamy material. They are underlain at a depth of 25 to 38 inches by calcareous sandy and gravelly material. Permeability is moderately rapid. Slope ranges from 0 to 1 percent.

Gilford soils are similar to Cohoctah and Vestaburg soils. Cohoctah soils have an organic-matter content that decreases irregularly with depth, and they are on low-lying flood plains. Vestaburg soils are sandy throughout and are in a similar position on the landscape to Gilford soils.

Typical pedon of Gilford sandy loam, gravelly substratum, 2,340 feet east and 60 feet south of the northwest corner of sec. 18, T. 11 N., R. 4 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) sandy loam, gray (10YR 5/1) dry; weak medium granular structure; friable; 11 percent pebbles; neutral; abrupt smooth boundary.

B21g—11 to 20 inches; dark gray (10YR 4/1) sandy loam that has few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium granular structure; friable; 8 percent pebbles; neutral; clear wavy boundary.

B22g—20 to 29 inches; gray (10YR 5/1) sandy loam that has many coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; 10 percent pebbles; neutral; abrupt wavy boundary.

IIC1g—29 to 40 inches; gray (10YR 6/1) coarse sand; single grained; loose; 12 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

IIC2g—40 to 60 inches; gray (10YR 5/1) gravelly sand; single grained; loose; 20 percent pebbles; 2 percent cobbles; strong effervescence; moderately alkaline.

The solum is 22 to 42 inches thick. Reaction typically is slightly acid or neutral throughout.

The A1 or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sandy loam, but in places it is fine sandy loam or gravelly analogs of these textures. It is less commonly loamy sand or loam. Thickness ranges from 10 to 12 inches.

The B2g horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is sandy loam or fine sandy loam. In some pedons, there are thin subhorizons of loamy sand.

The IICg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is coarse sand, very coarse sand, or gravelly sand. In some pedons, there are thin strata of sandy loam or loamy sand.

Houghton series

The Houghton series consists of very poorly drained soils on lowlands and flood plains. Permeability is moderately slow to moderately rapid. The soils formed in organic sediment, more than 50 inches thick, deposited in open water. Slope ranges from 0 to 1 percent.

Houghton soils are commonly adjacent to Saranac or Palms soils in most places. Unlike Houghton soils, Saranac soils lack an organic horizon throughout the pedon. Saranac soils are in a similar position on the landscape. Palms soils have a thinner deposit of organic material than Houghton soils and are underlain at a depth of 16 to 51 inches by loamy materials.

Typical pedon of Houghton muck, 700 feet south and 50 feet west of northeast corner of sec. 29, T. 9 N., R. 2 W.

Oa1—0 to 12 inches; black (10YR 2/1) broken face and rubbed sapric material; about 5 percent fiber, less than 5 percent when rubbed; about 20 to 30 percent mineral content; moderate fine granular; friable; herbaceous fibers; neutral; abrupt wavy boundary.

Oa2—12 to 24 inches; very dark brown (10YR 2/2) broken face and rubbed sapric material; about 15 percent fiber, less than 5 percent when rubbed; moderate medium subangular blocky structure; friable; herbaceous fibers; about 15 to 25 percent mineral content; neutral; clear wavy boundary.

Oa3—24 to 39 inches; dark brown (10YR 3/3) broken face sapric material, very dark brown (10YR 2/2) rubbed; about 25 percent fiber, less than 10 percent when rubbed; weak thin platy structure; friable; herbaceous fibers; about 10 to 15 percent mineral content; neutral; clear wavy boundary.

Oa4—39 to 45 inches; very dark brown (10YR 2/2) broken face and rubbed sapric material; about 15 percent fiber, less than 10 percent when rubbed; weak thin platy structure; friable; herbaceous fibers; neutral; abrupt wavy boundary.

Oa5—45 to 60 inches; very dark brown (10YR 2/2) broken face and rubbed sapric material; about 10 percent fiber, less than 10 percent when rubbed; massive; friable; herbaceous fibers; neutral.

The organic material is more than 50 inches thick. It is primarily herbaceous and consists mainly of sapric material. Reaction is slightly acid to neutral. Some pedons contain small woody fragments that can not be crushed between the fingers. In some places, there is a thin layer of hemic material less than 10 inches thick.

The Oa horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 0 to 3.

Huntington series

The Huntington series consists of well drained soils on flood plains. The soils formed in silty material deposited by flood waters. Permeability is moderate. Slope ranges from 1 to 5 percent.

Huntington soils are similar to Sloan soils. Sloan soils are very poorly drained and are in a slightly lower position on the landscape than Huntington soils.

Typical pedon of Huntington silt loam, 1 to 5 percent slopes, 1,330 feet east and 1,800 feet north of the southwest corner of sec. 27, T. 9 N., R. 1 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

B1—11 to 32 inches; dark brown (7.5YR 4/2) silt loam; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

B2—32 to 48 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

B3—48 to 55 inches; brown (10YR 5/3) silt loam that has common fine distinct light olive brown (2.5Y 5/6) mottles; massive; friable; mildly alkaline; gradual wavy boundary.

IIC1—55 to 60 inches; brown (10YR 5/3) fine sandy loam that has thin strata of silt loam and few fine faint light olive brown (2.5Y 5/4) mottles; massive; friable; slight effervescence; mildly alkaline.

The solum is 40 to 60 inches thick. Reaction ranges from slightly acid to neutral in the Ap, B1, and B2 horizons and to mildly alkaline in the B2 horizon. Coarse fragments, primarily of fine gravel, are commonly lacking but range from 0 to 4 percent by volume.

The Ap horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is 10 to 12 inches thick.

The B1 horizon has hue of 7.5YR or 10YR. The B2 and B3 horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. The B horizon is silt loam, heavy silt loam, or light silty clay loam. In some places, the B2 and B3 horizons have small pellets of manganese, 1 to 3 millimeters in size. In many places, there is a thin layer that has a high content of organic material. This layer has hue of 10YR, value of 2 or 3, and chroma of 1 or 3.

The IIC horizon is dominantly fine sandy loam and has thin strata of silt loam, sand, or gravel.

Ithaca series

The Ithaca series consists of somewhat poorly drained soils on uplands. The soils formed in calcareous loamy glacial till. Permeability is moderately slow. Slope ranges from 0 to 3 percent.

Ithaca soils are similar to Perrinton and Pert soils and commonly are adjacent to Perrinton soils. Perrinton soils are well drained and moderately well drained and are in a higher position than Ithaca soils on the landscape. Pert soils have a thinner solum than the Ithaca soils and are mainly on narrow ridges.

Typical pedon of Ithaca loam, 0 to 3 percent slopes, 2,620 feet south and 330 feet east of the northwest corner of sec. 27, T. 12 N., R. 3 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many roots; 3 percent pebbles; neutral; abrupt smooth boundary.

B&A—9 to 13 inches; brown (10YR 4/3) clay loam (Bt) that has few medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; grayish brown (10YR 5/2) loam (A2) that interfingers and surrounds some peds of (Bt); weak thin platy structure; friable; many roots; 3 percent pebbles; neutral; clear irregular boundary.

B21t—13 to 25 inches; brown (10YR 4/3) clay loam that has common few distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; very firm; thin continuous dark brown (10YR 3/3) clay films on faces of peds; 5 percent pebbles; neutral; gradual wavy boundary.

B22t—25 to 29 inches; brown (10YR 5/3) clay loam that has common medium distinct gray (10YR 5/1) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very firm; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; 5 percent pebbles; neutral; clear irregular boundary.

C—29 to 60 inches; brown (10YR 5/3) clay loam that has many medium distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; firm; 5 percent pebbles; slight effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. Reaction ranges from medium acid to neutral in the Ap, A2, and B21t horizons and from medium acid to mildly alkaline in the B22t horizon. The content of gravel in the solum and in the C horizon is less than 2 percent to 5 percent. The content of cobbles in the organic material is generally less than 1 percent.

Where present, the Ap or A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. An A2 horizon is absent in most pedons, but where present, it has hue of 10YR, value of 5 or 6, and chroma of 2. The A horizon is sandy loam or loam.

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam or clay. Content of clay ranges from 35 to 45 percent.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3.

Kingsville series

The Kingsville series consists of poorly drained and very poorly drained soils on lowlands. The soils formed in sandy material. Permeability is rapid. Slope ranges from 0 to 1 percent.

Kingsville soils are adjacent to Adrian, Pipestone, or Vestaburg soils in most places. Adrian soils have an organic horizon above the sand and are in a similar position on the landscape. Pipestone soils are somewhat poorly drained and are in a slightly higher position on the landscape than Kingsville soils. Vestaburg soils have shallower depths to calcareous gravelly sand than Kingsville soils and are,in a similar position on the landscape.

Typical pedon of Kingsville loamy sand, 1,320 feet south and 50 feet west of the northeast corner of sec. 4, T. 9 N., R. 1 W.

A1—0 to 6 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; slightly acid; abrupt wavy boundary.

C1g—6 to 26 inches; dark gray (10YR 4/1) loamy sand; weak fine granular structure; very friable; neutral; clear wavy boundary.

C2g—26 to 38 inches; gray (10YR 5/1) fine sand; single grained; loose; neutral; gradual wavy boundary.

C3g—38 to 50 inches; gray (10YR 5/1) sand that has many medium faint grayish brown (10YR 5/2) and few medium distinct dark gray (10YR 4/1) mottles; single grained; loose; neutral; gradual wavy boundary.

C4g—50 to 60 inches; dark gray (10YR 4/1) fine sand; single grained; loose; mildly alkaline.

The depth to sandy material typically is more than 40 inches. Reaction above 40 inches is slightly acid to mildly alkaline. The content of pebbles, above 40 inches, is less than 5 percent.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy sand, but in some places it is sand. Thickness ranges from 4 to 10 inches.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is dominantly sand or fine sand.

The upper part of the solum in Kingsville soils typically contains less acid than the range defined for the Kingsville series, but this difference does not alter the use or behavior of the soils.

Lamson series

The Lamson series consists of poorly drained and very poorly drained soils on lowlands. The soils formed in stratified loamy material. Permeability is moderately rapid. Slope ranges from 0 to 1 percent.

Lamson soils are commonly adjacent to Dixboro or Corunna soils in most places. Dixboro soils are somewhat poorly drained and are in a slightly higher position on the landscape than Lamson soils. Corunna soils are finer textured in the C horizon than Lamson soils and are in a similar position on the landscape.

Typical pedon of Lamson loamy very fine sand, 2,100 feet south and 50 feet east of the northwest corner of sec. 20, T. 10 N., R. 1 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loamy very fine sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; neutral; many fine roots; abrupt smooth boundary.

B1g—9 to 26 inches; very dark gray (10YR 4/1) loamy fine sand and few discontinuous thin, less than 1 inch thick, silt loam lenses that have common medium distinct light gray (10YR 7/2) mottles and black (10YR 2/1) organic matter pockets; weak medium platy structure; very friable; neutral; few roots; clear wavy boundary.

B2g—26 to 35 inches; light olive brown (2.5Y 5/3) loamy very fine sand that has few medium distinct yellowish red (5YR 5/6) and many fine distinct brownish yellow (10YR 6/6) and light gray (10YR 6/2) mottles; weak medium platy structure; very friable; mildly alkaline; gradual wavy boundary.

C1g—35 to 55 inches; grayish brown (2.5Y 5/2) very fine sand that has many fine faint light yellowish brown (2.5Y 6/4) mottles; single grained; loose; slight effervescence; mildly alkaline; abrupt wavy boundary.

C2g—55 to 60 inches; gray (10YR 5/1) very fine sand; single grained; loose; strong effervescence; mildly alkaline.

The solum is 30 to 45 inches thick. Reaction ranges from slightly acid to neutral in the Ap and B1g horizons and to mildly alkaline in the B2g horizon.

The A1 or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy very fine sand, but in places it is fine sandy loam.

The B1g horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1. The B2g horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. It is loamy very fine sand, very fine sand, or stratified very fine sand, fine sand, loamy very fine sand, very fine sandy loam, and silt loam.

The Cg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is very fine sand or stratified very fine sand, fine sand, loamy very fine sand, and silt.

Lenawee series

The Lenawee series consists of poorly drained and very poorly drained soils on lowlands. The soils formed in clayey and loamy lacustrine sediment. Permeability is moderately slow. Slope ranges from 0 to 1 percent.

Lenawee soils are similar to Toledo and Pert soils and are adjacent to them in some places. Toledo soils are finer textured in the B and C horizons than Lenawee soils and are in a similar position on the landscape. Pert soils are somewhat poorly drained and are in a slightly higher position on the landscape.

Typical pedon of Lenawee clay loam, 1,600 feet west and 350 feet north of the southeast corner of sec. 14, T. 9 N., R. 2 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) clay loam, gray (10YR 5/1) dry; weak medium subangular blocky structure parting to moderate medium granular; firm; neutral; abrupt wavy boundary.

B1g—9 to 13 inches; dark gray (10YR 4/1) clay loam; moderate medium subangular blocky structure; firm; neutral; clear wavy boundary.

B21g—13 to 18 inches; gray (10YR 5/1) clay loam that has few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; very firm; neutral; gradual wavy boundary.

B22g—18 to 37 inches; gray (10YR 5/1) clay loam that has common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium angular blocky structure; very firm; thin layers of gray (10YR 6/1) silt loam coatings over very fine sand in crevices and on ped faces; neutral; gradual wavy boundary.

C1g—37 to 55 inches; gray (10YR 5/1) clay loam that has common medium distinct yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; very firm; thin layers of gray (10YR 6/1) silt loam coatings on vertical ped faces; slight effervescence; mildly alkaline; abrupt wavy boundary.

C2g—55 to 60 inches; gray (10YR 5/1) clay that has many medium distinct yellowish brown (10YR 5/4) and few fine distinct yellowish brown (10YR 5/6) mottles; massive; very firm; thin layers of gray (10YR 6/1) silt loam coatings on vertical ped faces; slight effervescence; mildly alkaline.

The solum is 25 to 50 inches thick. Reaction is slightly acid to neutral in the Ap, B1g, and B21g horizons and slightly acid to mildly alkaline in the B22g horizon.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly clay loam, but in places it is silty clay loam, loam, or silt loam.

The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam, heavy silty clay loam, heavy clay loam, or light silty clay. The average content of clay in the organic material ranges from 35 to 40 percent.

The Cg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is heavy clay loam, light clay, and light silty clay and has thin strata of silt loam. In most pedons, the content of clay increases with depth and stratification becomes more prominent with depth.

Marlette series

The Marlette series consists of well drained and moderately well drained soils on uplands. The soils formed in calcareous, loamy glacial till. Permeability is moderately slow and moderate. Slope ranges from 2 to 12 percent.

Marlette soils are similar to Perrinton and Metea soils and are adjacent to Metea soils in most places. Perrinton soils are finer textured in the B horizon than Marlette soils and are in a similar position on the landscape. Metea soils are coarser textured in the A horizon and upper part of the B horizon than Marlette soils and are generally on the top of knolls or ridges.

Typical pedon of Marlette sandy loam, 2 to 6 percent slopes, 1,650 feet west and 100 feet north of the southeast corner of sec. 12, T. 11 N., R. 4 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) sandy loam; weak medium granular structure; friable; 5 percent pebbles; many roots; slightly acid; abrupt smooth boundary.

A2—10 to 14 inches; pale brown (10YR 6/3) sandy loam; weak thick platy structure parting to moderate fine angular blocky; friable; 3 percent pebbles; few roots; slightly acid; clear broken boundary.

B&A—14 to 20 inches; yellowish brown (10YR 5/4) loam (B) and pale brown (10YR 6/3) sandy loam; white (10YR 8/2) dry (A) coatings more than 2 millimeters thick on faces of peds and along worm and root channels; weak coarse prismatic structure parting to moderate medium angular and subangular blocky; friable; continuous brown (7.5YR 4/4) clay films on faces of peds; 4 percent pebbles; few roots; slightly acid; gradual irregular boundary.

B21t—20 to 26 inches; brown (7.5YR 5/4) clay loam and pale brown (10YR 6/3) sandy loam; white (10YR 8/1) dry coatings on faces of peds and along worm and root channels; moderate medium and coarse prismatic structure parting to moderate medium and coarse angular and subangular blocky; friable; continuous brown (10YR 4/3) clay films on faces of peds; 2 percent pebbles; few fine roots; neutral; clear irregular boundary.

B22t—26 to 34 inches; strong brown (7.5YR 5/6) loam and pale brown (10YR 6/3); white (10YR 8/2) dry coatings on faces of peds; moderate medium and coarse prismatic structure parting to moderate medium coarse angular and subangular blocky; friable; continuous brown (7.5YR 4/2) clay films on faces of peds; few iron-manganese concretions; 5 percent pebbles; few fine roots; neutral; clear wavy boundary.

C—34 to 60 inches; brown (10YR 5/3) loam; few fine distinct light olive brown (2.5Y 5/6) mottles; weak very coarse prismatic structure parting to weak coarse subangular blocky; friable; 5 percent pebbles; few roots; slight effervescence to strong effervescence; mildly alkaline.

The solum is 25 to 37 inches thick. Reaction ranges from slightly acid to neutral in the A and B21t horizons and from neutral or mildly alkaline in the B22t horizon. The content of coarse fragments ranges from 2 to 10 percent throughout the solum and in the C horizon.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. In wooded areas, the A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Where present, the A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. The Ap, A1, and A2 horizons are sandy loam or loam.

The B&A horizon is a mixture of the A2 and Bt horizons. It has the same color and texture as these horizons. The A2 horizon penetrates the Bt horizon in thin fingers between 2 and 10 millimeters wide and several inches long and makes up more than 15 percent, by volume, of the B&A horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is heavy loam, sandy clay loam, or clay loam.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. It is loam or light clay loam.

Martisco series

The Martisco series consists of very poorly drained soil on lowlands. The soils formed in organic material deposited in open water. They are underlain by marl. Permeability is moderately slow to moderately rapid in the organic material and slow in the underlying marl. Slope ranges from 0 to 1 percent.

Martisco soils are adjacent to Edwards or Thomas soils in most places. Edwards soils have an organic horizon that is thicker than 16 inches and are in a similar position on the landscape. Thomas soils have loamy material below the organic material and are also in a similar position on the landscape.

Typical pedon of Martisco muck, 2,060 feet north and 660 feet west of the southeast corner of sec. 4, T. 10 N., R. 4 W.

Oa1—0 to 8 inches; black (10YR 2/1) broken face and rubbed sapric material; about 10 percent fiber, less than 5 percent when rubbed; moderate medium granular structure; friable; herbaceous fibers; mildly alkaline; abrupt wavy boundary.

Oa2—8 to 12 inches; black (10YR 2/1) broken face and rubbed sapric material; less than 5 percent fiber, before and after rubbing; weak thick platy structure; friable; herbaceous fibers; mildly alkaline; abrupt wavy boundary.

Lca1—12 to 55 inches; light gray (10YR 7/1) marl; massive; friable; strong effervescence; moderately alkaline; gradual irregular boundary.

Lca2—55 to 60 inches; gray (10YR 5/1) marl; massive; friable; slight effervescence; moderately alkaline.

The thickness of the sapric organic material is 8 to 16 inches. The Oa horizon has hue of 10YR or is neutral; it has value of 2 and chroma of 0 to 2. It is calcareous in some pedons, especially in the lower part. Reaction typically is slightly acid to moderately alkaline. There are snail shells or shell fragments in some pedons.

The Lca horizon dominantly has hue of 10YR, value of 5 to 8, and chroma of 1 or 2. Thickness ranges from 3 to 20 feet or more.

Metamora series

The Metamora series consists of somewhat poorly drained soils on uplands. The soils formed in loamy glacial till. Permeability is moderately rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 2 percent.

Metamora soils are commonly adjacent to Capac and Dixboro soils in most places. Capac soils are finer textured in the upper part of the B horizon than Metamora soils and are in a similar position on the landscape. Dixboro soils are coarser textured in the C horizon than Metamora soils and are in a similar position on the landscape.

Typical pedon of Metamora sandy loam, in an area of Metamora-Capac sandy loams, 0 to 2 percent slopes, 650 feet east and 120 feet north of the southwest corner of sec. 19, T. 12 N., R. 3 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

B1g—9 to 33 inches; grayish brown (10YR 5/2) sandy loam that has common medium faint brown (10YR 5/3) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few roots; neutral; clear wavy boundary.

IIB2tg—33 to 37 inches; grayish brown (10YR 5/2) sandy clay loam that has many fine and medium distinct brown (10YR 4/3) and common medium faint dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; friable; clay films on few faces of peds; 3 percent pebbles; neutral; clear irregular boundary.

IIC—37 to 60 inches; brown (10YR 5/3) loam that has common medium distinct gray (10YR 5/1) and few fine faint pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable; 3 percent pebbles; slight effervescence; mildly alkaline.

The depth to the IIB2tg horizon is 20 to 35 inches. Reaction in the solum is slightly acid or neutral.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sandy loam, but in places it is loamy sand or fine sandy loam.

The B1g horizon has hue of 10YR, value of 5 or 6, and chroma of 2. It is sandy loam or heavy sandy loam.

The IIB2tg horizon has hue of 10YR, value of 5 or 6, and chroma of 2. It is sandy clay loam, clay loam, or silty clay loam.

The IIC horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 or 3. It is loam, silt loam, silty clay loam, or clay loam.

Metea series

The Metea series consists of well drained soils on uplands. The soils formed in sandy material. They are underlain at a depth of 20 to 40 inches by loamy glacial till. Permeability is very rapid in the sandy material and moderate to moderately slow in the underlying loamy material. Slope ranges from 0 to 6 percent.

Metea soils are similar to Marlette and Arkport soils and are often adjacent to them. Marlette soils are finer textured in the A horizon and upper part of the B horizon than Metea soils and are in a lower or similar position on the landscape. Arkport soils are coarser textured in the Bt and C horizons than Metea soils and are in a similar position on the landscape.

Typical pedon of Metea loamy sand, 0 to 6 percent slopes, 1,480 feet west and 75 feet south of the northeast corner of sec. 13, T. 12 N., R. 3 W.

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

B21—6 to 16 inches; yellowish brown (10YR 5/6) loamy sand; weak fine subangular blocky structure; very friable; slightly acid; gradual wavy boundary.

B22—16 to 33 inches; yellowish brown (10YR 5/4) loamy sand; weak fine subangular blocky structure; very friable; 3 percent pebbles; slightly acid; clear wavy boundary.

IIB2t—33 to 39 inches; yellowish brown (10YR 5/4) clay loam that has few medium faint yellowish brown (10YR 5/6) mottles; massive; firm; 4 percent pebbles; mildly alkaline; abrupt wavy boundary.

IIC—39 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; 6 percent pebbles; slight effervescence; mildly alkaline.

The depth to the IIBt horizon is 20 to 40 inches. Reaction in the sandy part of the solum is medium acid to slightly acid.

The A1 or Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly loamy sand, but in places it is sand. The B21 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sand or loamy sand. The B22 horizon has hue of 10YR, value of 4 or 5, and chroma of 4. In some pedons, there is an A'2 horizon.

The IIB2t and C horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3, 4, or 6. They are loam, clay loam, or silt loam.

Metea Variant

The Metea Variant consists of well drained and moderately well drained soils on uplands. The soils formed in sandy material that contains many cobbles. They are underlain at a depth of 20 to 40 inches by loamy glacial till. Permeability is rapid in the sandy material and moderately slow to moderate in the underlying loamy material. Slope ranges from 2 to 6 percent.

Metea Variant soils are commonly adjacent to Capac Variant soils in most places. Capac Variant soils are somewhat poorly drained and are finer textured than Metea Variant soils and are in a lower position on the landscape.

Typical pedon of Metea Variant cobbly loamy sand, 2 to 6 percent slopes, 2,590 feet south and 300 feet east of the northwest corner of sec. 34, T. 9 N., R. 3 W.

A1—0 to 7 inches; very dark gray (10YR 3/1) cobbly loamy sand; weak medium granular structure; very friable; 35 percent cobbles; 15 percent pebbles; neutral; abrupt wavy boundary.

B21—7 to 18 inches; dark brown (7.5YR 4/4) cobbly loamy sand; weak fine subangular blocky structure; very friable; 45 percent cobbles; 15 percent pebbles; neutral; clear wavy boundary.

B22—18 to 31 inches; dark yellowish brown (10YR 4/4) cobbly loamy sand; weak fine subangular blocky structure; very friable; 45 percent cobbles; 12 percent pebbles; neutral; clear wavy boundary.

IIB23t—31 to 37 inches; yellowish brown (10YR 5/4) loam that has common fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; 6 percent pebbles; 2 percent cobbles; neutral; abrupt wavy boundary.

IIC—37 to 60 inches; brown (10YR 5/3) loam that has few medium distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; friable; 5 percent pebbles; strong effervescence; moderately alkaline.

The depth to the IIBt horizon is 20 to 40 inches. Reaction is slightly acid to neutral in the sandy part of the solum and neutral to mildly alkaline in the IIB2t horizon. The solum below 20 inches is mottled in moderately well drained areas. The content of cobbles ranges from 30 to 60 percent, by volume, of the sandy material.

The A1 or Ap horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is dominantly cobbly loamy sand, but in places it is cobbly sand. In a few places, it is gravelly analogs of these textures.

The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3, 4, or 6. It is cobbly loamy sand or cobbly sand.

The IIBt and C horizons have hue of 10YR, value of 4 to 6, and chroma of 3, 4, or 6. They are loam, clay loam, or silt loam.

Oakville series

The Oakville series consists of well drained and moderately well drained soils on uplands. The soils formed in fine sand. Permeability is very rapid. Slope ranges from 0 to 6 percent.

Oakville soils are similar to Plainfield and Spinks soils. Plainfield soils have a greater amount of medium sand than Oakville soils to a depth of at least 40 inches and are in a similar position on the landscape. Spinks soils have a B horizon of heavy loamy sand and are in a similar position on the landscape.

Typical pedon of Oakville fine sand, 0 to 6 percent slopes, 1,194 feet west and 40 feet south of the northeast corner of sec. 36, T. 10 N., R. 1 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) fine sand; weak fine granular structure; very friable; slightly acid; abrupt wavy boundary.

B2—6 to 15 inches; yellowish brown (10YR 5/6) fine sand; single grained; loose; slightly acid; gradual wavy boundary.

B3—15 to 25 inches; brownish yellow (10YR 6/6) fine sand; single grained; loose; slightly acid; clear wavy boundary.

C1—25 to 60 inches; light yellowish brown (10YR 6/4) fine sand; single grained; loose; neutral.

The solum is 20 to 40 inches thick. Reaction is slightly acid to neutral throughout. Mottles that have chroma of 3 or higher are at a depth of 20 to 36 inches in some pedons.

The A1 or Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. It is dominantly fine sand, but in places it is loamy fine sand.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 4 or 6. The B3 horizon has hue of 10YR, value of 5 or 6, and chroma of 4 or 6.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3, 4, or 6. It is fine sand or sand. In some pedons, the C2 horizon contains free carbonates.

Olentangy series

The Olentangy series consists of very poorly drained soils on lowlands. The soils formed in organic and mineral sediment deposited in open water. They are underlain at a depth of 24 to 50 inches by lacustrine material or glacial till. Permeability is moderately slow to moderately rapid in the organic and mineral sediment and slow in the underlying lacustrine material or glacial till. Slope ranges from 0 to 1 percent.

Olentangy soils are adjacent to Parkhill soils in most places. Parkhill soils lack the organic and Lco horizons, and Palms soils lack the Lco horizon. Parkhill and Palms soils are in a similar position on the landscape.

Typical pedon of Olentangy muck, 1,830 feet west and 1,220 feet south of the northeast corner of sec. 16, T. 12 N., R. 3 W.

Oa1—0 to 9 inches; black (10YR 2/1) broken face and rubbed sapric material; about 10 percent fiber, less than 5 percent when rubbed; moderate fine granular structure; friable; herbaceous fibers; 10 to 20 percent mineral content; neutral; abrupt smooth boundary.

Oa2—9 to 13 inches; black (10YR 2/1) broken face sapric material, very dark brown (10YR 2/2) rubbed; about 10 percent fiber, less than 5 percent when rubbed; weak medium subangular blocky structure; friable; herbaceous fibers; 10 to 20 percent mineral content; common roots; neutral; clear smooth boundary.

Lco1—13 to 26 inches; black (10YR 2/1) broken face mucky silt loam, very dark brown (10YR 2/2) rubbed; moderate fine platy structure; friable; few roots; neutral; abrupt wavy boundary.

Lco2—26 to 35 inches; dark gray (10YR 4/1) mucky silt loam that has few fine and medium distinct yellowish brown (10YR 5/8) mottles; weak fine platy structure; friable; very few roots; neutral; abrupt smooth boundary.

Lco3—35 to 38 inches; grayish brown (5GY 5/2) silt loam that has few thin, 1/2- to 1-inch thick, layers of black (10YR 2/1) organic material and few fine distinct yellowish brown (10YR 5/8) mottles; massive; friable; few white (10YR 8/1) snail shells and shell fragments; very few roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

IICg—38 to 60 inches; grayish brown (10YR 5/2) silt loam that has few fine faint olive yellow (2.5Y 6/6) mottles; massive; friable; strong effervescence; moderately alkaline.

The thickness of the coprogenous earth and the depth to the IICg horizon are 24 to 50 inches. Reaction typically is slightly acid to neutral in the Oa and Lco1 horizons and neutral to moderately alkaline in the Lco2 and Lco3 horizons.

The Oa horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. In some pedons, there is a thin layer of hemic organic material as much as 6 inches thick. The combined thickness of sapric material and hemic organic material does not exceed 16 inches.

The Lco horizon has hue of 10YR or 5GY, value of 2 to 6, and chroma of 1 or 2. Shell fragments range from none to many.

The IIC horizon has hue of 10YR or is neutral; it has value of 5 or 6 and chroma of 0 to 2. It is sandy loam, silt loam, or silty clay loam.

Palms series

The Palms series consists of very poorly drained soils on flood plains. The soils formed in organic sediment deposited in open water. They are underlain at a depth of 16 to 50 inches by loamy material. Permeability is moderately slow to moderately rapid in the organic material and moderate or moderately slow in the underlying loamy material. Slopes range from 0 to 1 percent.

Palms soils are similar to Olentangy and Houghton soils and are adjacent to them in some places. Olentangy soils have an Lco horizon, and Houghton soils lack loamy material above 50 inches. Olentangy and Houghton soils are in a similar position on the landscape.

Typical pedon of Palms muck, 1,700 feet south and 500 feet west of the northeast corner of sec. 27, T. 9 N., R. 2 W.

Oa1—0 to 14 inches; black (10YR 2/1) broken face and rubbed sapric material; about 5 percent fiber, less than 5 percent when rubbed; moderate medium granular structure; friable; herbaceous fibers; about 20 to 25 percent mineral content; slightly acid; abrupt smooth boundary.

Oa2—14 to 28 inches; black (10YR 2/1) broken face and rubbed sapric material; about 5 percent fiber, less than 5 percent when rubbed; massive parting to weak coarse subangular blocky structure; friable; herbaceous fibers; 10 to 20 percent mineral content; medium acid; abrupt smooth boundary.

Oa3—28 to 35 inches; black (N 2/0) broken face sapric material, black (10YR 2/1) rubbed; about 5 percent fiber, less than 5 percent when rubbed; massive; friable; herbaceous fibers, 10 to 20 percent mineral content; slightly acid; abrupt smooth boundary.

IICg—35 to 60 inches; gray (10YR 5/1) clay loam that has common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; friable; 2 percent pebbles; strong effervescence; neutral in the upper part and moderately alkaline in the lower part.

The depth to the IICg horizon ranges from 16 to 50 inches, but it typically is 16 to 40 inches. Reaction in the Oa horizon is medium acid to neutral. The fiber is derived primarily from herbaceous plants. Fragments of twigs, branches, or logs which range from 1/8 inch to 6 inches in diameter make up less than 15 percent, by volume, of some pedons.

The Oa horizon has hue of 10YR or is neutral; it has value of 2 or 3 and chroma of 0 to 2. The Oa3 horizon has hue of 7.5YR in a few places.

The IICg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silt loam, fine sandy loam, or clay loam. The average clay content is less than 35 percent. In some places, there are thin strata of sand. Reaction is slightly acid to moderately alkaline and has no effervescence to strong effervescence.

Parkhill series

The Parkhill series consists of poorly drained and very poorly drained soils on lowlands. The soils formed in calcareous loamy glacial till. Permeability is moderately slow. Slope ranges from 0 to 1 percent.

Parkhill soils are commonly adjacent to Belleville and Olentangy soils in most places. Belleville soils are coarser textured than Parkhill soils in the upper 20 to 40 inches and are in a similar position on the landscape. Olentangy soils have an organic horizon and an Lco horizon and are also in a similar position on the landscape.

Typical pedon of Parkhill loam, 1,415 feet east and 300 feet south of the northwest corner of sec. 16, T. 11 N., R. 1 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam; gray (10YR 5/1) dry; weak coarse subangular blocky structure parting to weak medium granular; friable; 3 percent pebbles; many fine roots; slightly acid; abrupt smooth boundary.

B21g—9 to 13 inches; grayish brown (10YR 5/2) clay loam that has many coarse distinct yellowish brown (10YR 5/8) and few coarse distinct dark gray (10YR 4/1) mottles; weak coarse subangular blocky structure parting to weak fine subangular blocky; firm; many grain coatings on vertical faces; 3 percent pebbles; common fine roots; neutral; clear wavy boundary.

B22g—13 to 18 inches; gray (10YR 5/1) clay loam that has many coarse distinct yellowish brown (10YR 5/4) and many coarse faint gray (10YR 6/1) mottles; weak coarse subangular blocky structure parting to weak fine subangular blocky; firm; few dark gray (10YR 4/1) organic fillings in some pores; 2 percent pebbles; common fine roots; neutral; clear wavy boundary.

B23g—18 to 28 inches; gray (10YR 5/1) clay loam that has common coarse distinct yellowish brown (10YR 5/6) and many medium faint gray (10YR 6/1) mottles; weak coarse angular blocky structure; firm; thick dark greenish gray (5GY 4/1) silt coatings on some vertical faces and fillings in some pores; 5 percent pebbles; few fine roots; neutral; clear wavy boundary.

B3g—28 to 36 inches; gray (10YR 5/1) clay loam that has few coarse distinct yellowish brown (10YR 5/8) and many coarse faint gray (10YR 6/1) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; thick greenish gray (5GY 4/1) silt coatings on vertical faces; 8 percent pebbles; few fine roots; mildly alkaline; gradual wavy boundary.

C1g—36 to 51 inches; gray (10YR 6/1) and yellowish brown (10YR 5/8) loam that has mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; friable; thick greenish gray (5GY 5/1) silt coatings on vertical faces along cracks; 8 percent pebbles; few fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

C2—51 to 60 inches; yellowish brown (10YR 5/4) loam that has few coarse faint yellowish brown (10YR 5/6) and few fine distinct gray (10YR 5/1) mottles; moderate coarse platy structure parting to medium platy; friable; 10 percent pebbles; few concretions and flecks of manganese, 2 to 5 millimeters thick; strong effervescence; mildly alkaline.

The solum ranges from 20 to 45 inches in thickness, but it typically is 33 to 40 inches thick. Reaction is slightly acid or neutral in the Ap and B2 horizons and neutral or mildly alkaline in the B3g horizon.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loam, but in places it is silt loam and gravelly sandy loam.

The B2g horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is clay loam, heavy loam, sandy clay loam, silty clay loam, or gravelly analogs of these textures. In some places, there is a B1g horizon.

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

Perrinton series

The Perrinton series consists of well drained and moderately well drained soils on uplands. The soils formed in loamy, calcareous glacial till. Permeability is moderately slow. Slope ranges from 2 to 12 percent.

Perrinton soils are similar to Ithaca and Marlette soils and are adjacent to Ithaca soils in most places. Ithaca soils are somewhat poorly drained, and they generally are in a lower position on the landscape than Perrinton soils. Marlette soils are coarser textured in the B horizon than Perrinton soils and are in a similar position on the landscape.

Typical pedon of Perrinton loam, 2 to 6 percent slopes, 2,350 feet east and 20 feet south of the northwest corner of sec. 9, T. 9 N., R. 3 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable; many fibrous roots; 5 percent pebbles; neutral; abrupt wavy boundary.

B&A—8 to 14 inches; brown (10YR 4/3) clay loam (B21t) moderate fine angular blocky structure; grayish brown (10YR 5/2) loam (A2) that interfingers and surrounds some peds of (Bt); friable; many fine roots; 5 percent pebbles; neutral; clear wavy boundary.

B22t—14 to 25 inches; yellowish brown (10YR 5/4) clay; moderate medium angular blocky structure; very firm; thin dark brown (10YR 4/3) clay films on faces of peds; light brownish gray (10YR 6/2) coatings on faces of peds and fillings in cracks in upper 3 to 5 inches; 5 percent pebbles; neutral; gradual wavy boundary.

B3—25 to 32 inches; yellowish brown (10YR 5/4) clay loam; weak medium subangular blocky structure; firm; thin patchy dark brown (10YR 4/3) coatings on some faces of peds; 5 percent pebbles; mildly alkaline; abrupt wavy boundary.

C—32 to 60 inches; brown (10YR 5/3) clay loam; massive; firm; 8 percent pebbles; slight effervescence; mildly alkaline.

The solum is 24 to 40 inches thick. Reaction is slightly acid to neutral in the A and B2 horizons.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. An A2 horizon is present in some places. The A horizon is dominantly loam, but in places it is sandy loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The B21t horizon is clay loam or silty clay loam, and the B22t horizon is clay or heavy silty clay loam. The content of clay in the Bt horizon ranges from 35 to 45 percent. The B3 horizon is mottled in some places.

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

Pert series

The Pert series consists of somewhat poorly drained soils. on uplands. The soils formed in clayey and loamy lacustrine material. Permeability is moderately slow or slow. Slope ranges from 0 to 2 percent.

Pert soils are similar to Lenawee and Ithaca soils and are adjacent to Lenawee soils in most places. Lenawee soils are predominantly gray in the B horizon and have greater depths to the C horizon than Pert soils. They are in a slightly higher position on the landscape, generally on narrow ridges. Ithaca soils have greater depths to the C horizon than Pert soils and are in a similar position on the landscape.

Typical pedon of Pert clay loam, 0 to 2 percent slopes, 200 feet west and 200 feet north of the southeast corner of sec. 17, T. 9 N., R. 2 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) clay loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; 5 percent pebbles; neutral; abrupt smooth boundary.

B2t—9 to 15 inches; brown (10YR 5/3) clay that has common fine distinct yellowish brown (10YR 5/6) and many fine and medium faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; continuous dark grayish brown (10YR 4/2) clay films on most faces of peds; very firm; 3 percent pebbles; neutral; clear wavy boundary.

B3—15 to 19 inches; brown (10YR 5/3) clay loam that has many fine and medium faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very firm; 5 percent pebbles; slight effervescence; mildly alkaline; abrupt wavy boundary.

Cg—19 to 60 inches; grayish brown (10YR 5/2) clay loam that has many medium distinct yellowish brown (10YR 5/4) mottles; massive; firm; 5 percent pebbles; strong effervescence; moderately alkaline.

The solum is 12 to 22 inches thick. Reaction ranges from slightly acid to neutral in the Ap and Bt horizons and from neutral to mildly alkaline in the B3 horizon.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly clay loam, but in places it is silty clay loam.

The B2t and B3 horizons have hue of 10YR, value of 4 to 6, and chroma of 2 or 3. They are heavy clay loam, light clay, or heavy silty clay loam.

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

Pipestone series

The Pipestone series consists of somewhat poorly drained soils on uplands. The soils formed in sandy material. Permeability is rapid. Slope ranges from 0 to 2 percent.

Pipestone soils are commonly adjacent to Tedrow and Kingsville soils in most places. Unlike Pipestone soils, Tedrow soils lack the spodic horizons in the upper part of the B horizon. Tedrow soils are in a similar position to Pipestone soils on the landscape. Kingsville soils are predominantly gray below the A horizon and are in a slightly lower position on the landscape than Pipestone soils.

Typical pedon of Pipestone loamy sand, in an area of Pipestone-Tedrow loamy sands, 0 to 2 percent slopes, 600 feet north and 100 feet west of the southeast corner of sec. 1, T. 12 N., R. 1 W.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many roots; slightly acid; abrupt wavy boundary.

A2—6 to 9 inches; light gray (10YR 7/2) sand; single grained; loose; medium acid; clear irregular or broken boundary.

B21ir—9 to 16 inches; dark brown (7.5YR 4/4) sand that has few fine medium faint strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and yellowish red (5YR 5/8) mottles; single grained; loose; few fragments of weakly cemented ortstein 1/4 to 1 inch in diameter; medium acid; clear irregular or broken boundary.

B22—16 to 31 inches; light yellowish brown (10YR 6/4) sand that has few fine and medium faint grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; slightly acid; gradual wavy boundary.

B23—31 to 44 inches; brown (10YR 5/3) sand that has common medium faint grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; neutral; clear wavy boundary.

Cg—44 to 60 inches; grayish brown (10YR 5/2) sand that has few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; neutral.

The solum is 30 to 46 inches thick. Reaction is strongly acid to slightly acid in the Ap, B21ir, and B22 horizons and slightly acid or neutral in the B23 horizon.

In cultivated areas, plowing has mixed the upper part or all of the A2 horizon with the A1 horizon. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. Where present, the A2 horizon has hue of 10YR, value of 6 or 7, and chroma of 1 or 2. It is sand or loamy sand.

The B21ir horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 or 6. In a few places, there is a Bhir horizon. It has hue of 5YR, value of 3 or 4, and chroma of 2 to 4. The amount of ortstein in the B21ir horizon is variable. The ortstein occurs mainly as small fragments, as much as 4 inches in diameter, or as random indurated tongues.

The B2 and B23 horizons have hue of 10YR, value of 5 or 6, and chroma of 3, 4, or 6.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. Pebbles occur in some pedons but make up less than 10 percent, by volume. In some places, below 40 inches, the C horizon is loam, clay loam, or silty clay loam.

Plainfield series

The Plainfield series consists of excessively drained soils on uplands. The soils formed in sand. Permeability is rapid. Slope ranges from 0 to 18 percent.

Plainfield soils are similar to Oakville soils and are commonly adjacent to Boyer soils in most places. Oakville soils have a larger amount of fine sand than Plainfield soils to a depth of 40 inches or more and are in a similar position on the landscape. Boyer soils are finer textured in the B horizon than Plainfield soils and are in a similar position on the landscape.

Typical pedon of Plainfield loamy sand, 0 to 6 percent slopes, 250 feet north and 75 feet west of the southeast corner of sec. 18, T. 11 N., R. 4 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loamy sand; weak fine granular structure; very friable; few fibrous roots; slightly acid; abrupt smooth boundary.

B21—7 to 12 inches; yellowish brown (10YR 5/6) sand; single grained; loose; slightly acid; clear wavy boundary.

B22—12 to 30 inches; brownish yellow (10YR 6/6) sand; single grained; loose; slightly acid; clear wavy boundary.

C1—30 to 50 inches; yellow (10YR 7/6) sand; single grained; loose; slightly acid; clear wavy boundary.

C2—50 to 60 inches; very pale brown (10YR 7/4) sand; single grained; loose; slightly acid.

The solum is 20 to 34 inches thick. Reaction ranges from strongly acid to slightly acid, but it typically is slightly acid throughout. In a few pedons, the C2 horizon is neutral.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2. If the moist color is very dark grayish brown (10YR 3/2), the dry color is light brownish gray (10YR 6/2). The Ap horizon is dominantly loamy sand, but in places it is sand.

The B horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is dominantly medium sand and contains variable amounts of fine sand and coarse sand. There are a few pebbles in some pedons.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 4 to 6.

Riverdale series

The Riverdale series consists of somewhat poorly drained soils on uplands. The soils formed in sandy and loamy material. They are underlain at a depth of 24 to 38 inches by gravelly sandy material. Permeability is moderately rapid. Slope ranges from 0 to 2 percent.

Riverdale soils are similar to Ceresco soils and are adjacent to Tedrow soils in most places. Ceresco soils are finer textured than Riverdale soils in the A and B horizons, and they have an organic-matter content that decreases irregularly with depth. They are on the flood plains. Unlike Riverdale soils, Tedrow soils lack a Bt horizon. Tedrow soils are in a similar position to the Riverdale soils on the landscape.

Typical pedon of Riverdale loamy sand, 0 to 2 percent slopes, 1,900 feet west and 140 feet north of the southeast corner of sec. 6, T. 12 N., R. 3 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; 11 percent pebbles; few fibrous roots; neutral; abrupt smooth boundary.

B11—8 to 14 inches; strong brown (7.5YR 5/6) loamy sand that has few fine distinct light yellowish brown (10YR 6/4) mottles; weak fine subangular blocky structure; very friable; 8 percent pebbles; slightly acid; clear wavy boundary.

B12—14 to 28 inches; pale brown (10YR 6/3) sand that has common fine and medium faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; 10 percent pebbles; neutral; clear wavy boundary.

B2t—28 to 33 inches; yellowish brown (10YR 5/6) gravelly sandy loam that has common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few thin discontinuous clay films on faces of peds and in pores; 20 percent pebbles; neutral; gradual wavy boundary.

IICg—33 to 60 inches; grayish brown (10YR 5/2) gravelly sand; single grained; loose; 25 percent pebbles; 1 percent cobbles; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. Reaction is slightly acid to mildly alkaline throughout. The content of gravel ranges from 2 to 20 percent.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy sand, but in places it is sand. Where present, the A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is gravelly sandy loam or sandy loam and has thin layers of gravelly loamy sand in places.

The IICg horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is gravelly sand or stratified sand or gravel.

Saranac series

The Saranac series consists of poorly drained and very poorly drained soils on flood plains. The soils formed in clayey material deposited in flood waters. Permeability is moderately slow. Slope ranges from 0 to 1 percent.

Saranac soils are similar to Sloan soils and commonly are adjacent to Houghton soils in some places. Sloan soils are coarser textured throughout than Saranac soils and are in a similar position on the landscape. Houghton soils have an organic horizon and are in a similar position on the landscape.

Typical pedon of Saranac silty clay loam, frequently flooded, 1,480 feet west and 400 feet south of the northeast corner of sec. 19, T. 9 N., R. 1 W.

Ap—0 to 12 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate coarse granular structure; firm; neutral; abrupt smooth boundary.

A12—12 to 23 inches; dark gray (10YR 4/1) silty clay loam; weak medium subangular blocky structure; firm; neutral; clear wavy boundary.

B2g—23 to 37 inches; gray (10YR 5/1) silty clay that has few medium distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; very firm; neutral; gradual wavy boundary.

A1b—37 to 40 inches; very dark brown (10YR 2/2) silty clay loam; massive; firm; undecomposed leaves and twigs; mildly alkaline; clear wavy boundary.

C1g—40 to 55 inches; gray (10YR 5/1) silty clay that has common medium distinct light olive brown (2.5Y 5/4) mottles; massive; very firm; mildly alkaline.

C2g—55 to 60 inches; dark gray (10YR 4/1) silty clay that has many coarse distinct yellowish brown (10YR 5/6) mottles; massive; very firm; slight effervescence; mildly alkaline.

The predominant depth to calcareous material is 40 to 60 inches, but it is more than 60 inches in some places.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly silty clay loam, but in places it is clay loam or silt loam. The A horizon is slightly acid to mildly alkaline. The Ap horizon is 10 to 14 inches thick.

The B2g horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. Very dark brown (10YR 2/2) coatings are on faces of peds in some pedons. The B2g horizon is heavy silty clay loam, heavy clay loam, or light clay. Content of clay commonly is 35 to 45 percent but ranges from 35 to 60 percent.

The A1b horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silty clay loam or clay loam.

The C horizon has hue of 10YR, 2.5Y, and 5Y, value of 4 to 6, and chroma of 1 or 2. It is heavy silty clay loam, heavy clay loam, or light silty clay. In some pedons, there are thin strata of silt, fine sand, or gravel.

Selfridge series

The Selfridge series consists of somewhat poorly drained soils on uplands. The soils formed in sandy material. They are underlain at a depth of 24 to 40 inches by loamy glacial till. Permeability is rapid in the sandy material and moderate or moderately slow in the underlying loamy material. Slope ranges from 0 to 2 percent.

Selfridge soils are similar to Capac and Wixom soils and are often adjacent to them. Capac soils are finer textured in the A horizon and upper part of the B horizon than Selfridge soils and are in a similar position on the landscape. Wixom soils have a spodic horizon.

Typical pedon of Selfridge loamy sand, 0 to 2 percent slopes, 2,550 feet east and 55 feet north of the southwest corner of sec. 12, T. 12 N., R. 2 W.

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; few roots; neutral; abrupt smooth boundary.

B1—9 to 22 inches; brown (10YR 5/3) loamy sand that has many fine faint grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; very friable; neutral; clear wavy boundary.

B21—22 to 32 inches; light yellowish brown (10YR 6/4) sand that has common fine distinct grayish brown (10YR 5/2) and few medium faint yellowish brown (10YR 5/6) mottles; single grained; loose; mildly alkaline; clear wavy boundary.

IIB22t—32 to 36 inches; brown (10YR 5/3) loam that has few medium faint grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; friable; thin discontinuous clay films on faces of peds; 4 percent pebbles; mildly alkaline; clear irregular boundary.

IIC1—36 to 39 inches; brown (10YR 5/3) clay loam that has many fine and medium faint grayish brown (10YR 5/2) mottles; massive; firm; thin gray (10YR 5/1) coatings on faces of some peds; 2 percent pebbles; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC2g—39 to 60 inches; grayish brown (10YR 5/2) clay loam that has few medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; 3 percent pebbles; strong effervescence; moderately alkaline.

The depth to the IIC horizon is 24 to 40 inches. Reaction ranges from slightly acid to neutral in the Ap, B11, and B12 horizons and to mildly alkaline in the IIB2t horizon.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy sand, but in places it is sand.

The B1 and B21 horizons have hue of 10YR, value of 5 or 6, and chroma of 3, 4, or 6. They are sand, fine sand, loamy fine sand, or loamy sand.

The IIB2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3, 4, or 6. It is loam, sandy loam, sandy clay loam, or heavy loam.

The IIC horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 3. It is loam, clay loam, or silty clay loam. In some places, the IIC horizon contains varves of silt and very fine sand.

Sickles series

The Sickles series consists of poorly drained and very poorly drained soils on lowlands. The soils formed in sandy material. They are underlain at a depth of 24 to 40 inches by calacareous, clayey lacustrine sediment. Permeability is rapid in the sandy material and slow in the underlying clayey lacustrine sediment. Slope ranges from 0 to 1 percent.

Sickles soils are similar to Toledo and Arkona soils and often are adjacent to them. Toledo soils are finer textured than Sickles soils in the upper horizons and are in a similar position on the landscape. Unlike Sickles soils, Arkona soils lack predominantly gray matrix colors below the A horizon. Arkona soils are in a slightly higher position than Sickles soils on the landscape.

Typical pedon of Sickles loamy sand, 1,900 feet east and 60 feet north of the southwest corner of sec. 3, T. 9 N., R. 1 W.

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

C1g—9 to 25 inches; dark gray (10YR 4/1) loamy sand that has strata and lumps of black (10YR 2/1) organic matter; weak fine subangular blocky structure; very friable; 5 percent pebbles; few fine roots; neutral; clear wavy boundary.

C2g—25 to 36 inches; gray (10YR 5/1) sand; single grained; loose; 5 percent pebbles; neutral; gradual wavy boundary.

IIC3g—36 to 60 inches; gray (10YR 5/1) silty clay; massive; very firm; 3 percent pebbles; strong effervescence; moderately alkaline.

The depth to the IIC horizon is 24 to 40 inches. Reaction in the substratum is slightly acid to neutral.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy sand, but in places it is sand and loamy fine sand.

The Cg horizon as hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is sand, loamy sand, or loamy fine sand.

The IIC3g horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is clay or silty clay.

Sloan series

The Sloan series consists of very poorly drained soils on flood plains. The soils formed in loamy material deposited by flood water. Permeability is moderate to moderately slow. Slope ranges from 0 to 1 percent.

Sloan soils are similar to Huntington, Saranac, and Cohoctah soils and are adjacent to Huntington soils. Unlike Sloan soils, Huntington soils lack gray matrix colors below the A horizon. Huntington soils are in a slightly higher position than Sloan soils on the landscape. Saranac soils are finer textured throughout and Cohoctah soils are coarser textured throughout than Sloan soils and are in a similar position on the landscape.

Typical pedon of Sloan loam, wet, 1,760 feet north and 100 feet east of the southwest corner of sec. 13, T. 9 N., R. 4 W.

A1—0 to 11 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; weak medium granular structure; friable; few fibrous roots; neutral; abrupt wavy boundary.

A12g—11 to 20 inches; dark gray (10YR 4/1) loam; weak medium subangular blocky structure; friable; few fibrous roots; neutral; clear wavy boundary.

B21g—20 to 31 inches; very dark gray (10YR 3/1) loam that has few fine and medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; 3 percent pebbles; neutral; clear wavy boundary.

A1b—31 to 35 inches; black (10YR 2/1) silt loam; weak medium subangular blocky structure; friable; some partially decomposed leaves; neutral; gradual wavy boundary.

B22g—35 to 47 inches; gray (10YR 5/1) silt loam that has common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; 4 percent pebbles; mildly alkaline; abrupt wavy boundary.

Cg—47 to 60 inches; gray (10YR 5/1) stratified sandy loam and silt loam that has common medium distinct yellowish brown (10YR 5/8) mottles; massive; friable; 5 percent pebbles; slight effervescence; mildly alkaline.

The depth to calcareous material is 36 to 50 inches. Thin strata of sand or gravel occur in some places. Reaction ranges from slightly acid to neutral in the A1, A12, and B21g horizons and to mildly alkaline in the A1b and B22g horizons.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The A12g horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. It is loam, heavy loam, or silt loam.

The B2g horizon has hue of 10YR, 2.5Y, or 5Y, value of 2 to 5, and chroma of 1 or 2. It is silty clay loam, silt loam, clay loam, or loam. There is some variation because of stratification.

The A1b horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silt loam or loam. The A1b horizon is absent in a few pedons.

The Cg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2.

Spinks series

The Spinks series consists of well drained soils on uplands. The soils formed in stratified sandy material. Permeability is rapid to moderately rapid. Slope ranges from 0 to 12 percent.

Spinks soils are similar to Arkport and Oakville soils and are adjacent to Arkport and Boyer soils. Arkport soils are finer textured in the B and C horizons than Spinks soils and generally are in a lower position on the landscape. Unlike Spinks soils, Oakville soils lack an argillic horizon. Oakville soils are in a similar position to Spinks soils on the landscape. Boyer soils have a finer textured, continuous Bt horizon and are shallower in depth to the C horizon than Spinks soils. They are also in a similar position on the landscape.

Typical pedon of Spinks loamy sand, 0 to 6 percent slopes, 1,250 feet west and 970 feet north of the southeast corner of sec. 8, T. 10 N., R. 4 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loamy sand; weak fine granular structure; very friable; many fibrous roots; slightly acid; abrupt smooth boundary.

A2—9 to 20 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose; neutral; abrupt irregular boundary.

A&B—20 to 46 inches; yellowish brown (10YR 5/4) sand (A2); single grained; loose; dark brown (7.5YR 4/4) lamellae and bands of heavy loamy sand (Bt); weak fine subangular blocky structure; very friable; neutral; clear wavy boundary.

C—46 to 60 inches; pale brown (10YR 6/3) sand; single grained; loose; 2 percent pebbles; neutral.

The solum is 38 to 70 inches thick. Reaction ranges from medium acid to neutral in the Ap and A2 horizons and to mildly alkaline in the lower part of the A&B horizon.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly loamy sand, but in places it is sand, fine sand, or loamy fine sand.

The A2 horizon has hue of 10YR, value of 4 to 6, and chroma of 4 or 6. It is loamy sand, fine sand, or sand. The A2 part of the A&B horizon has hue of 10YR, value of 5 or 6, and chroma of 3, 4, or 6. It is sand or fine sand.

The depth to the first band of the B horizon ranges from 15 to 36 inches. The B part of the A&B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. The individual bands or lamellae of the B horizon range from loamy sand to light sandy loam or heavy loamy fine sand. The bands generally are discontinuous, and they range from 1/8 inch to 5 inches in thickness and are spaced about 5 to 10 inches apart. They have a combined thickness of more than 6 inches.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is dominantly sand or fine sand, but in some places coarse sand, very coarse sand, or gravelly sand is below 50 inches. The C horizon is neutral to moderately alkaline.

Tedrow series

The Tedrow series consists of somewhat poorly drained soils on uplands. The soils formed in sandy material. Permeability is rapid. Slope ranges from 0 to 2 percent.

The Tedrow soils are commonly adjacent to Pipestone or Riverdale soils. Pipestone soils have a spodic horizon and are in a similar position to Tedrow soils on the landscape. Riverdale soils have a Bt horizon and are also in a similar position on the landscape.

Typical pedon of Tedrow loamy sand, 0 to 2 percent slopes, 2,600 feet north and 600 feet west of the southeast corner of sec. 23, T. 12 N., R. 2 W.

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 fibrous roots; slightly acid; abrupt smooth boundary.

B21—9 to 17 inches; yellowish brown (10YR 5/4) sand that has few fine faint brown (10YR 5/3) mottles; single grained; loose; slightly acid; gradual wavy boundary.

B22—17 to 29 inches; brown (10YR 5/3) sand that has common fine faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; neutral; gradual irregular boundary.

B3—29 to 45 inches; pale brown (10YR 6/3) sand that has many fine and medium faint light brownish gray (10YR 6/2) and few fine distinct brownish yellow (10YR 6/6) mottles; single grained; loose; neutral; abrupt wavy boundary.

C—45 to 60 inches; light brownish gray (10YR 6/2) sand; 4 percent pebbles; single grained; loose; slight effervescence; mildly alkaline.

The solum is 36 to 45 inches thick. The depth to carbonates is the same as the solum thickness in most places. Reaction ranges from slightly acid to neutral in the A1 and B2 horizons and to mildly alkaline in the B3 horizon.

The Ap horizon commonly has hue of 10YR, value of 3, and chroma of 1 or 2. Where present, the A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy sand, but in places it is sand and fine sand.

The B21 horizon has hue of 10YR, value of 4 or 5, and chroma of 4 or 6. The B22 and B3 horizons have hue of 10YR, value of 5 or 6, and chroma of 3 or 4. They are sand or fine sand. Iron stains are common in the B22 and B3 horizons. They have hue of 7.5YR, value of 4 to 6, and chroma of 4 to 8.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is sand or fine sand.

Thomas series

The Thomas series consists of poorly drained and very poorly drained soils on lowlands. The soils formed in calcareous, loamy, lacustrine sediment. Permeability is slow or moderately slow. Slope ranges from 0 to 1 percent.

Thomas soils are adjacent to Martisco or Tobico soils in some places. Martisco soils are underlain by marl below the organic horizon and are in a similar position to Thomas soils on the landscape. Tobico soils are coarser textured below the organic horizon than Thomas soils and are also in a similar position on the landscape.

Typical pedon of Thomas muck, 1,950 feet east and 550 feet south of the northwest corner of sec. 2, T. 10 N., R. 3 W.

Oap—0 to 9 inches; black (10YR 2/1) broken face and rubbed sapric material; less than 5 percent fiber before and after rubbing; moderate fine and medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

B1g—9 to 17 inches; dark gray (10YR 4/1) clay loam that has few medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; 3 percent pebbles; 1 percent cobbles; common roots; slight effervescence; mildly alkaline; clear wavy boundary.

C1g—17 to 38 inches; gray (10YR 5/1) clay loam that has many fine to medium distinct yellowish brown (10YR 5/6) and few medium and coarse distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; 2 percent pebbles; 1 percent cobbles; few roots; slight effervescence; mildly alkaline; abrupt wavy boundary.

C2g—38 to 60 inches; gray (10YR 6/1) loam that has many coarse distinct yellowish brown (10YR 5/6) and few medium distinct light yellowish brown (10YR 6/4) mottles; massive; friable; 4 percent pebbles; 1 percent cobbles; slight effervescence; moderately alkaline.

The solum ranges from 10 to 24 inches in thickness, but it typically is 14 to 20 inches thick. Reaction ranges from neutral to moderately alkaline.

The Oa horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. In some places, it is neutral and has value of 2 and chroma of 0. It is dominantly sapric organic material as much as 16 inches thick. In some places, primarily cultivated areas, the Oa horizon is mucky loam, mucky silt loam, or mucky sandy loam.

The Bg horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is loam, clay loam, silty clay loam, silt loam, or sandy clay loam. In some places, the upper part of the B horizon is sandy loam.

The Cg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. In some places, the chroma is 3 or 4 below 30 inches. The Cg horizon is loam, silt loam, silty clay loam, and clay loam.

Tobico series

The Tobico series consists of poorly drained and very poorly drained soils on lowlands. The soils formed in calcareous sandy material. Permeability is very rapid. Slope ranges from 0 to 1 percent.

Tobico soils are adjacent to Thomas and Vestaburg soils. Thomas soils are finer textured below the organic horizon than Tobico soils and are in a similar position on the landscape. Unlike Tobico soils, Vestaburg soils lack the organic horizon and have a higher content of gravel in the profile. They are also in a similar position on the landscape.

Typical pedon of Tobico muck, 1,265 feet south and 50 feet east of the northwest corner of sec. 2, T. 10 N., R. 4 W.

Oa1—0 to 9 inches; black (N 2/0) broken face and rubbed sapric material; less than 5 percent fiber before and after rubbing; moderate medium granular structure; friable; many roots; mildly alkaline; abrupt wavy boundary.

C1g—9 to 14 inches; dark gray (10YR 4/1) sand that has few fine distinct yellowish brown (10YR 5/4) mottles; single grained; loose; 5 percent pebbles; mildly alkaline; clear wavy boundary.

C2g—14 to 29 inches; grayish brown (10YR 5/2) sand that has few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; 3 percent pebbles; slight effervescence; mildly alkaline; clear wavy boundary.

C3g—29 to 34 inches; gray (10YR 5/1) gravelly sand; many fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; 20 percent pebbles; strong effervescence; mildly alkaline; abrupt wavy boundary.

C4g—34 to 60 inches; gray (10YR 5/1) sand; single grained; loose; 2 percent pebbles; strong effervescence; moderately alkaline.

The depth to calcareous material typically is 6 to 15 inches.

The Oa horizon has hue of 10YR or is neutral, value of 2, and chroma of 0 to 2. In some places, there is an A horizon of mucky sand or sand 5 to 10 inches thick. Free carbonates are in some places.

The C1g horizon has hue of 10YR or 5Y, value of 4 or 5, and chroma of 1 or 2. It is sand or fine sand. The C2g and C3g horizons have hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or 2. They are dominantly sand and fine sand, but there are thin layers of gravelly sand.

Toledo series

The Toledo series consists of very poorly drained soils on lowlands. The soils formed in calcareous, clayey lacustrine sediment. Permeability is slow. Slope ranges from 0 to 1 percent.

Toledo soils are similar to Wauseon, Lenawee, and Sickles soils and are generally adjacent to them. Wauseon and Sickles soils are coarser textured in the upper horizons than Toledo soils and are in a similar position on the landscape. Lenawee soils are coarser textured in the B and C horizons than Toledo soils and are in a similar position on the landscape.

Typical pedon of Toledo clay loam, 2,630 feet west and 300 feet south of the northeast corner of sec. 16, T. 9 N., R. 1 W.

Ap—0 to 9 inches; dark grayish brown (10YR 3/2) clay loam, gray (10YR 5/1) dry; weak medium subangular blocky structure; firm; slightly acid; abrupt smooth boundary.

B21g—9 to 13 inches; dark gray (10YR 4/1) clay loam that has few medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; slightly acid; clear wavy boundary.

B22g—13 to 19 inches; gray (10YR 5/1) silty clay that has common medium distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak medium angular blocky structure; firm; neutral; gradual wavy boundary.

B23g—19 to 27 inches; gray (10YR 5/1) silty clay that has many medium distinct strong brown (7.5YR 5/6) or yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; very firm; thin discontinuous silt coatings on vertical faces of peds; neutral; gradual wavy boundary.

B24g—27 to 36 inches; gray (10YR 5/1) silty clay that has common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium angular blocky structure; very firm; thin silt coatings and strata of silt and very fine sand in crevices and on faces of peds; neutral; gradual wavy boundary.

B3g—36 to 48 inches; gray (10YR 5/1) silty clay that has common medium distinct gray (2.5Y 6/0) and olive brown (2.5Y 4/4) mottles; moderate medium angular blocky structure; very firm; thin coatings of gray (10YR 6/1) silt and very fine sand or sandy loam in crevices and coatings on faces of peds; mildly alkaline; clear wavy boundary.

Cg—48 to 60 inches; gray (2.5Y 6/0) silty clay that has common medium distinct light olive brown (2.5Y 5/8) mottles; massive; very firm;

thin layers of silt and very fine sand in crevices and coatings on faces of peds; slight effervescence; mildly alkaline.

The solum is 30 to 50 inches thick. Reaction ranges from slightly acid to neutral in the Ap and B2g horizons and to mildly alkaline in the B3g horizon.

The Ap horizon has hue of 10YR, value of 3, and chroma of 1 or 2. It is dominantly clay loam, but in places it is silty clay loam or heavy clay loam.

The Bg horizon has hue of 10YR or 2.5Y or is neutral, value of 4 to 6 and chroma of 0 to 2. Very thin, very patchy clay films are on faces of peds in some places. Content of gravel is 1 to 5 percent.

The Cg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 0 to 2. In some places, subhorizons have chroma of 4 or 6.

Vestaburg series

The Vestaburg series consists of poorly drained and very poorly drained soils on lowlands. The soils formed in calcareous, gravelly and sandy outwash material. Permeability is rapid. Slope ranges from 0 to 1 percent.

Vestaburg soils are similar to Gilford, Kingsville, and Tobico soils and are generally adjacent to Kingsville and Tobico soils. Gilford soils have a loamy B2 horizon and are in a similar position on the landscape. Kingsville soils have a greater depth to calcareous gravelly sand than Vestaburg soils and are in a similar position on the landscape. Tobico soils have an organic horizon in the upper part of the profile and a greater depth to calcareous gravelly sand than Vestaburg soils and are also in a similar position on the landscape.

Typical pedon of Vestaburg loamy sand, 2,540 feet west and 1,250 feet south of the northeast corner of sec. 7, T. 10 N., R. 3 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loamy sand, gray (10YR 5/1) dry; weak, medium granular stucture; very friable; 12 percent pebbles; neutral; abrupt smooth boundary.

C1g—8 to 25 inches; gray (10YR 5/1) sand that has common medium faint dark gray (10YR 4/1) mottles; single grained; loose; 10 percent pebbles; neutral; clear wavy boundary.

C2g—25 to 60 inches; grayish brown (10YR 5/2) gravelly sand; single grained; loose; 30 percent pebbles; strong effervescence; moderately alkaline.

The depth to calcareous gravelly sand is from 20 to 35 inches. Content of pebbles commonly ranges from 5 to 20 percent in the A horizon and upper part of the C horizon and from 20 to 50 percent in the lower part of the C horizon.

Where present, the Ap or A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly loamy sand, but in places it is sand or mucky loamy sand. Reaction is neutral to mildly alkaline.

The C1g horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 0 to 2. It is neutral to mildly alkaline. The C2g horizon has colors similar to those of the C1g horizon.

Wauseon series

The Wauseon series consists of very poorly drained soils on lowlands. The soils formed in loamy material. They are underlain at a depth of 24 to 36 inches by calcareous, clayey lacustrine sediment. Permeability is rapid in the loamy material and very slow in the underlying clayey sediment. Slope ranges from 0 to 1 percent.

Wauseon soils are similar to Corunna and Toledo soils and are adjacent to Toledo soils. Corunna soils are coarser textured in the IIC horizon than Wauseon soils and are in a similar position on the landscape. Toledo soils are finer textured in the A and B horizons than Wauseon soils and are also in a similar position on the landscape.

Typical pedon of Wauseon sandy loam, 1,450 feet west and 150 feet north of the southeast corner of sec. 15, T. 9 N., R. 1 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) sandy loam, gray (10YR 5/1) dry; weak medium to coarse granular structure; friable; slightly acid; abrupt smooth boundary.

B21g—11 to 21 inches; gray (10YR 5/1) sandy loam that has few medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; friable; 2 percent pebbles; neutral; clear wavy boundary.

B22g—21 to 32 inches; gray (10YR 5/1) sandy loam that has common fine and medium distinct yellowish brown (10YR 5/8) and brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; friable; 3 percent pebbles; neutral; abrupt wavy boundary.

IIC1g—32 to 40 inches; gray (10YR 5/1) silty clay loam that has few to many medium to coarse distinct yellowish brown (10YR 5/6 and 5/8) and strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; very firm; 2 percent pebbles; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC2g—40 to 60 inches; gray (10YR 5/1) silty clay that has few to common medium distinct yellowish brown (10YR 5/6) mottles; massive; very firm; 2 percent pebbles; slight effervescence; mildly alkaline.

The solum is 24 to 40 inches thick. Reaction typically is slightly acid to neutral but is mildly alkaline in the lower part of the B22g horizon in some places.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sandy loam, but in places it is fine sandy loam and loamy fine sand.

The B horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is dominantly sandy loam or fine sandy loam, but in places it is fine sand.

The IICg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is dominantly clay or silty clay, but in places it is heavy silty clay loam.

Wixom series

The Wixom series consists of somewhat poorly drained soils on uplands. The soils formed in sandy material. They are underlain at a depth of 24 to 37 inches by loamy glacial till. Permeability is rapid in the sandy material and moderately slow in the underlying loamy material. Slope ranges from 0 to 2 percent.

Wixom soils are similar to Selfridge and Arkona soils and are adjacent to Selfridge soils. Unlike Wixom soils, Selfridge soils lack a spodic horizon. Selfridge soils are in a similar position to Wixom soils on the landscape. Arkona soils are finer textured in the IIB and IIC horizons than Wixom soils and are in a similar position on the landscape.

Typical pedon of Wixom loamy sand, 0 to 2 percent slopes, 750 feet south and 100 feet west of the northeast corner of sec. 24, T. 11 N., R. 1 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) loamy sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

A2—10 to 16 inches; light brownish gray (10YR 6/2) sand; single grained; loose; few roots; slightly acid; abrupt broken boundary.

B21ir—16 to 24 inches; dark brown (7.5YR 4/4) sand that has few fine and medium faint strong brown (7.5YR 5/6) mottles; single grained; loose; small fragments of ortstein; slightly acid; gradual broken boundary.

B22ir—24 to 33 inches; brownish yellow (10YR 6/6) sand that has common fine distinct light brownish gray (10YR 6/2) and few medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; slightly acid; clear wavy boundary.

A'2—33 to 38 inches; light yellowish brown (10YR 6/4) loamy sand that has many fine faint grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; very friable; 5 percent pebbles; few thin discontinuous bands of dark brown (7.5YR 4/4) loamy sand; neutral; gradual wavy boundary.

IIB'2tg—38 to 42 inches; grayish brown (10YR 5/2) clay loam that has common medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; thin coatings on some faces of peds in the upper part; weak medium subangular blocky structure; firm; 3 percent pebbles; neutral; abrupt wavy boundary.

IICg—42 to 60 inches; grayish brown (10YR 5/2) clay loam that has many medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; 5 percent pebbles; slight effervescence; mildly alkaline.

The thickness of the sandy material is 20 to 40 inches. The sandy part of the solum is medium acid to neutral. It is sand or loamy sand.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. There is no A2 horizon in some places, especially in cultivated areas. Where present, it has hue of 10YR, value of 5 or 6, and chroma of 1 or 2.

The B2ir horizon has hue of 7.5YR, value of 4 to 6, and chroma of 4 to 6. Some pedons have hue of 10YR or 5YR.

The A'2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4.

The IIB'2tg horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is light clay loam, heavy loam, or silt loam. In some places, thick coatings of material from the A'2 horizon are on the faces of peds and fillings in cracks and root channels in the upper part of the IIB'2tg horizon.

The IICg horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is loam or clay loam.

Formation of the soils

This section discusses the factors of soil formation, relates them to the formation of soils in the survey area, and explains the processes of soil formation.

Factors of soil formation

Soil forms through the interaction of five major factors: the physical, chemical, and mineral composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land, including the depth to the water table; and the length of time the processes of soil formation have acted on the parent material.

Climate and plant and animal life are the active forces in soil formation. These forces slowly change the parent material into a natural body of soil that has genetically-related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material also affects the kind of soil profile that is developed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be long or short, but some time is required for differentiation of soil horizons. Generally, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent material

Parent material is the unconsolidated mass from which soil forms. The parent material of the soils of Gratiot County was deposited by glaciers and by glacial melt water. Some of this material subsequently was reworked and redeposited by water and wind. The glaciers covered the county 10,000 to 12,000 years ago.

Parent material determines the chemical and mineralogical composition of soil. Although the parent material of the soils in the survey area is of common glacial origin, its properties vary greatly, sometimes within a short distance, depending on how it was deposited. The dominant parent material of soils in Gratiot County was deposited as glacial till, outwash deposits, lacustrine deposits, alluvium, and organic material.

Glacial till is material laid down directly by glaciers with a minimum of water action. The till consists of mixed particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Gratiot County is calcareous. Its texture is loam, silty clay loam, clay loam, silty clay, and clay. Perrinton soils, for example, formed in glacial till. These soils typically are moderately fine textured and have well developed structure.

Outwash material is deposited by running water from melting glaciers. The size of the particles that make up outwash material varies according to the rate of streamflow. When the water slows, coarse particles are deposited. Fine particles, such as very fine sand, silt, and clay, are carried by slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sandy loam, sand, gravel, and other coarse particles. Boyer soils, for example, formed in deposits of outwash material.

Lacustrine material is deposited by still, or ponded, glacial melt water. Because the coarse fragments are deposited by moving water as outwash, only the fine particles, such as very fine sand, silt, and clay, remain. These particles settle in still water. In Gratiot County, soils that formed in lacustrine deposits are typically medium textured, moderately fine textured, and fine textured. Lenawee soils, for example, formed in lacustrine material.

Alluvium is deposited by floodwaters of present streams in recent geologic time. It ranges in texture, depending on the rate of streamflow. Alluvium that was redeposited along a swift stream, for example, the Pine River, is coarser textured than alluvium that was deposited along a sluggish stream, for example, the Maple River. Cohoctah and Sloan soils formed in deposits of alluvium.

Organic material consists of plant remains deposited by bodies of water. After the glaciers withdrew from the area, water left standing in depressions formed lakes on outwash plains, flood plains, moraines, and till plains. Grasses and sedges growing at the edge of these lakes died, and their remains sank to the bottom. Because of the wetness of the areas, the plant remains did not decompose. Later, water-tolerant trees grew in the areas. As these trees died, their residue added to the organic accumulation. Consequently, the lakes eventually filled with organic material and developed muck soils. Houghton soils formed in organic material.

Plant and animal life

Green plants have been the principal organism that influences the soils in Gratiot County, but bacteria, fungi, earthworms, and human activities have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kinds of plants that grew in the soil. The remains of these plants accumulate on the surface; they decay and eventually become organic matter. Plant roots provide channels for downward movement of water through the soil and add organic matter as the plants decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The vegetation in Gratiot County was mainly deciduous forest. Differences in natural soil drainage and minor changes in parent material affected the composition of the forests.

Generally, such well drained soils as Marlette, Perrinton, and Boyer soils, on uplands were mainly covered with sugar maple and hickory. Oakville soils were covered with scrub oak; and the wet soils were covered mainly with soft maple, elm, and ash. Corunna and Parkhill soils formed under wet conditions, and they contain a considerable amount of organic matter.

Climate

Climate is an important factor in the formation of soils. It determines the kind of plant and animal life on and in the soil and the amount of water that is available for weathering of minerals and for transporting of soil material. Climate, through its influence on temperatures in the soil, determines the rate of chemical reaction in the soil. These influences are important, but they affect large areas rather than such a relatively small area as a county.

The climate in Gratiot County is cool and humid. It is presumably similar to that which existed when the soils formed. The soils in Gratiot County differ from soils that formed in a dry, warm climate or from those that formed in a hot, moist climate. Climate is uniform throughout the county, although its effect is modified locally by the proximity to large lakes. Differences in climate result in only minor differences in the soils of Gratiot County.

Relief

Relief, or topography, has a marked influence on the soils of Gratiot County through its influence on natural drainage, erosion, plant cover, and soil temperature. In Gratiot County, slopes range from 0 to 18 percent. Natural soil drainage ranges from well drained on ridgetops to very poorly drained in depressions.

Relief influences the formation of soils by affecting runoff and drainage; then drainage, through its affect on aeration of the soil, determines the color of the soil. Runoff is greatest on the steeper slopes. In low areas, water is temporarily ponded. Water and air move freely through soils that are well drained, but they move slowly through soils that are very poorly drained. In well aerated soils, the iron and aluminum compounds that give color to most soils are brightly colored and oxidized. Poorly aerated soils are dull gray and mottled. Marlette soils are well drained and well aerated; Parkhill soils are poorly aerated and very poorly drained. Marlette and Parkhill soils formed in similar parent material.

Time

Time is required by the agents of soil formation to develop distinct horizons from parent material. Generally, a long time is required. The differences in the length of time that the parent material has been in place are commonly reflected in the degree of development of the soil profile. Some soils form rapidly, others form slowly.

The soils in Gratiot County range from young to mature. The glacial deposits in which many of these soils formed have been exposed to soil-forming factors for a sufficiently long time to allow distinct horizons to develop. Some soils forming in recent alluvial sediment have not been in place for a sufficient amount of time for distinct horizons to develop.

Sloan soils are young soils that formed in alluvial material. Parkhill soils are evidence of the effect of more time used for leaching of lime from the soil.

Genesis and morphology

The processes, or soil-forming factors, responsible for the development of soil horizons from the unconsolidated parent material are referred to as soil genesis. The physical, chemical, and biological properties of the various soil horizons are termed soil morphology.

Several processes were involved in the development of soil horizons in the soils of Gratiot County; (1) accumulation of organic matter, (2) leaching of lime (calcium carbonates) and other bases, (3) reduction and transfer of iron, and (4) formation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in horizon development.

Organic matter accumulated on the surface to form an A1 horizon. The A1 horizon is mixed into a plow layer (Ap) when the soil is plowed. In the soils of Gratiot County, organic-matter content ranges from high to low in the surface layer. Cohoctah soils have a high organic-matter content in the surface layer, and Plainfield soils have a low organic-matter content.

Leaching of carbonates and other bases occurred in most soils. Soil scientists generally agree that leaching of bases in soils generally precedes the translocation of silicate clay minerals. Many soils are moderately leached to strongly leached. Tedrow soils are leached of carbonates to a depth of 45 inches, and Riverdale soils are leached to a depth of only 33 inches. Differences in the depths of leaching are a result of time as a soil-forming factor.

The reduction and transfer of iron, called gleying, is evident in somewhat poorly drained, poorly drained, and very poorly drained soils. A gray horizon in the subsoil indicates the reduction and loss of iron. Gleying and the reduction processes occurred in Lenawee soils.

Translocation of clay minerals has contributed to horizon development. The eluviated, or leached, A2 horizon above the illuviated B horizon has a platy structure, is lower in content of clay, and typically is lighter in color. The B horizon typically has an accumulation of clay (clay films) in pores and on ped faces. These soils were probably leached of carbonates to a considerable extent before translocation of silicate clay occurred. The leaching of bases and the translocation of silicate clays are among the more important processes in horizon differentiation. Perrinton soils have translocated silicate clays in the form of clay films that accumulated in the B horizon.

In some soils, iron, aluminum, and humus have moved from the surface layer to the B horizon. The color of the B horizon in such soils is dark brown. Arkona, Pipestone, and Wixom soils translocated iron, aluminum, and humus, which affected 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.

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

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.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

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.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay 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.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A map 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 earthmoving equipment. The soil sloughs easily.

Deep to water. This soil is deep to a permanent water table during the dry season.

Delta. An alluvial deposit, commonly triangular in shape, formed largely beneath water and deposited at the mouth of a river or stream.

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.

Droughty. In dry periods, the soil holds too little water for plant growth.

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.

Erodes easily. The soil is easily eroded by water.

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 humus. The soil contains too much organic matter.

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.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured (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.

Foot slope. The inclined surface at the base of a hill.

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.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes by water originating mainly from the melting of glacial ice. Many are interbedded or laminated.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

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.

Hard to pack. This soil is difficult to compact.

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.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. 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.

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.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

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.

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.

No water. This soil is too deep to ground water.

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 landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

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.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

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 forms 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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Soil scientists regard as soil only the part of the regolith that is modified by organisms and other soil-building forces. Most engineers describe the whole regolith, even to a great depth, as "soil."

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

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.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

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 blowing. Soil material is easily moved and deposited by wind.

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.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

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.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that 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.

Tile drain. Concrete, plastic, or ceramic pipe used to provide water outlets from the soil. The pipe is placed in the surface layer or subsoil at a suitable depth and at suitable intervals.

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.

Too clayey. The soil is slippery and sticky when wet and is slow to dry.

Too sandy. The soil is soft and loose, droughty, and low in fertility.

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.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

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.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within 1 year; specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in a glacial lake or other body of still water in front of a glacier.

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.

Wetness. The soil is wet during the period of use.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Illustrations

Figure 1.—Dark-colored Parkhill soils and the light-colored Capac Variant in an area of Capac Variant-Parkhill complex.

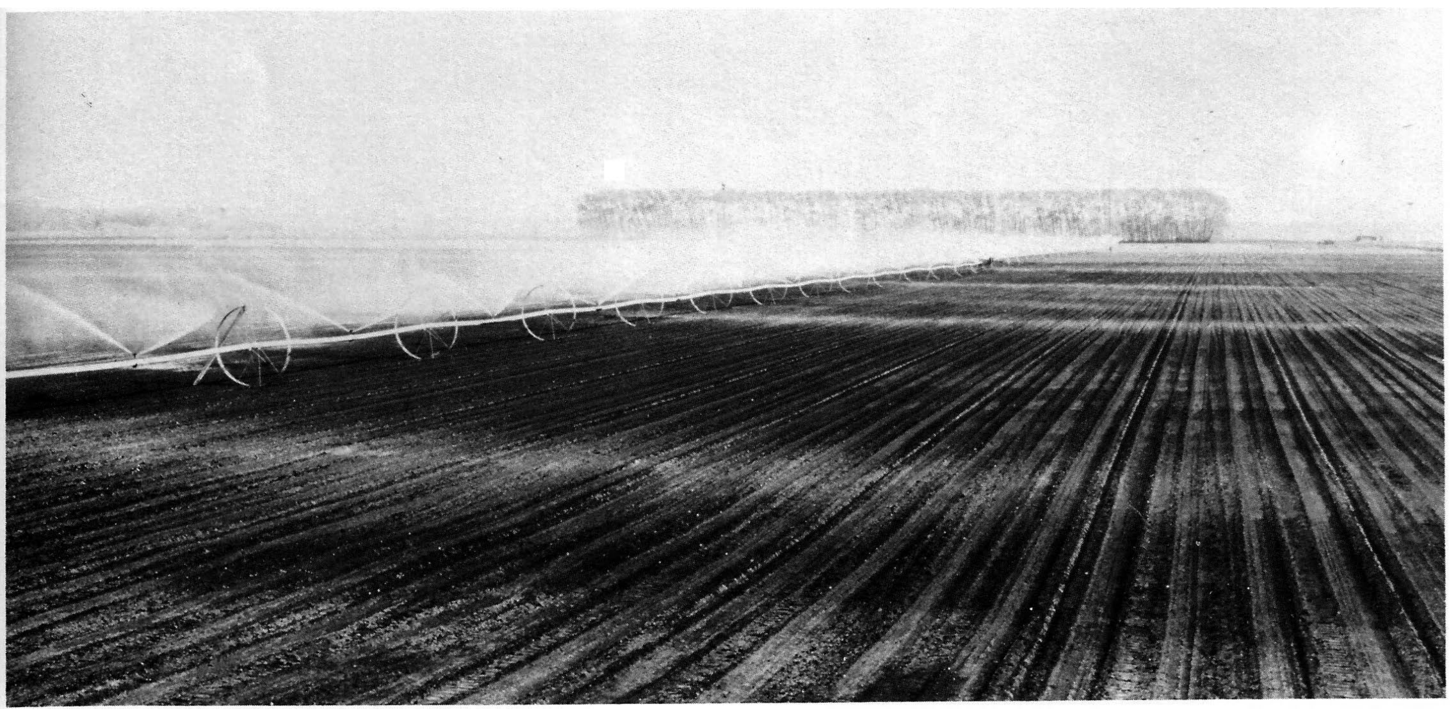

Figure 2.—Sprinkler irrigation helps to control soil blowing on Palms muck.

Figure 3.—Pipestone-Tedrow loamy sands, 0 to 2 percent slopes. The foreground is planted to corn, and the background is a typical wooded area of birch and aspen.

Figure 4.—Willows planted on Tobico muck to prevent soil blowing.

Figure 5.—Water standing in low areas of Toledo clay loam where a tile system has not been installed.

Figure 6.—Installation of a subsurface drainage system to remove excess water from Capac loam, 0 to 3 percent slopes.

Figure 7.—Soil blowing in an unprotected area of Selfridge loamy sand, 0 to 2 percent slopes.

Figure 8.—Grassed waterway in a gently sloping area of Perrinton loam, 2 to 6 percent slopes.

Figure 9.—Water from a flowing stream impounded behind a dam on Lenawee clay loam.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded at Alma in the period 1945-74]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum higher than--	2 years in 10 will have-- Minimum 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 0.1 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	30.0	14.3	22.2	52	-15	0	1.47	.67	2.15	4	10.8
February---	32.6	14.6	23.6	51	-14	0	1.26	.65	1.79	4	8.9
March------	42.6	24.1	33.4	71	- 2	10	1.99	1.16	2.72	5	8.0
April------	58.0	35.5	46.8	82	17	79	2.91	1.83	3.88	7	1.7
May--------	69.4	44.7	57.1	87	27	257	3.06	1.93	4.09	7	T[2]
June-------	79.7	55.5	67.6	95	37	536	3.12	1.94	4.19	6	0
July-------	83.8	59.3	71.5	95	44	675	2.79	1.43	3.97	6	0
August-----	82.0	57.7	69.9	95	42	624	3.31	1.98	4.50	6	0
September--	74.0	50.8	62.4	92	31	385	3.11	1.71	4.35	6	0
October----	63.3	41.5	52.4	84	23	155	2.35	1.17	3.38	5	0.2
November---	46.4	31.1	38.7	70	7	15	2.34	1.54	3.07	6	3.4
December---	34.3	20.4	27.4	59	- 4	0	1.98	.95	2.87	5	8.2
Year-----	58.0	37.4	47.7	97	-16	2,736	29.69	26.25	33.01	67	41.2

[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 survey area (50° F).

[2]Trace.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded at Alma in the period 1930-74]

Probability	Minimum 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 24	May 11	May 23
2 years in 10 later than-----	April 20	May 6	May 18
5 years in 10 later than-----	April 12	April 27	May 10
First freezing temperature in fall:			
1 year in 10 earlier than---	October 21	October 4	September 21
2 years in 10 earlier than---	October 26	October 10	September 26
5 years in 10 earlier than---	November 5	October 22	October 6

TABLE 3.--GROWING SEASON LENGTH

[Data were recorded at Alma in the period 1930-74]

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-	186	157	129
8 years in 10-	193	164	136
5 years in 10-	207	177	148
2 years in 10-	220	190	160
1 year in 10--	227	197	167

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ad	Adrian muck	2,490	0.7
AfA	Aquents-Udorthents complex, 0 to 3 percent slopes	225	0.1
AkA	Arkona loamy sand, 0 to 2 percent slopes	1,135	0.3
ArB	Arkport loamy fine sand, 1 to 6 percent slopes	3,290	0.9
ArC	Arkport loamy fine sand, 6 to 12 percent slopes	410	0.1
Be	Belleville loamy sand	7,530	2.1
BoB	Boyer loamy sand, 0 to 6 percent slopes	6,855	1.9
CaA	Capac loam, 0 to 3 percent slopes	43,960	12.0
CcA	Capac Variant-Parkhill complex, 0 to 2 percent slopes	3,125	0.9
Ce	Ceresco fine sandy loam, gravelly substratum	1,290	0.4
Ch	Cohoctah fine sandy loam, gravelly substratum	1,055	0.3
Co	Cohoctah-Ceresco fine sandy loams, gravelly substratum	1,815	0.5
Cr	Corunna sandy loam	10,490	2.9
DxA	Dixboro fine sandy loam, 0 to 3 percent slopes	6,005	1.7
Ed	Edwards muck	505	0.1
Gd	Gilford sandy loam, gravelly substratum	3,335	0.9
Ho	Houghton muck	2,320	0.6
HuB	Huntington silt loam, 1 to 5 percent slopes	285	0.1
ItA	Ithaca loam, 0 to 3 percent slopes	10,355	2.9
Ke	Kingsville loamy sand	10,375	2.9
La	Lamson loamy very fine sand	2,945	0.8
Le	Lenawee clay loam	19,890	5.5
MaB	Marlette sandy loam, 2 to 6 percent slopes	12,390	3.4
MaC	Marlette sandy loam, 6 to 12 percent slopes	5,100	1.4
Mc	Martisco muck	320	0.1
MeA	Metamora-Capac sandy loams, 0 to 2 percent slopes	14,015	3.9
MtB	Metea loamy sand, 0 to 6 percent slopes	3,025	0.8
MvB	Metea Variant cobbly loamy sand, 2 to 6 percent slopes	640	0.2
OaB	Oakville fine sand, 0 to 6 percent slopes	3,415	0.9
Oe	Olentangy muck	395	0.1
Pa	Palms muck	1,110	0.3
Ph	Parkhill loam	80,580	22.1
PkB	Perrinton loam, 2 to 6 percent slopes	5,555	1.5
PkC	Perrinton loam, 6 to 12 percent slopes	4,350	1.2
PlA	Pert clay loam, 0 to 2 percent slopes	4,050	1.1
PpA	Pipestone-Tedrow loamy sands, 0 to 2 percent slopes	5,325	1.5
PrA	Pipestone-Tedrow loamy sands, loamy substratum, 0 to 2 percent slopes	3,100	0.9
Ps	Pits	950	0.3
PtB	Plainfield loamy sand, 0 to 6 percent slopes	3,560	1.0
PtC	Plainfield loamy sand, 6 to 18 percent slopes	585	0.2
RdA	Riverdale loamy sand, 0 to 2 percent slopes	5,400	1.5
Sa	Saranac silty clay loam, frequently flooded	2,650	0.7
SeA	Selfridge loamy sand, 0 to 2 percent slopes	19,670	5.4
Sk	Sickles loamy sand	4,345	1.2
Sn	Sloan loam, wet	2,090	0.6
SpB	Spinks loamy sand, 0 to 6 percent slopes	1,545	0.4
SpC	Spinks loamy sand, 6 to 12 percent slopes	640	0.2
TdA	Tedrow loamy sand, 0 to 2 percent slopes	8,625	2.4
TeA	Tedrow loamy sand, loamy substratum, 0 to 2 percent slopes	6,755	1.9
Th	Thomas muck	2,950	0.8
Tm	Tobico muck	1,490	0.4
To	Toledo clay loam	8,185	2.3
Ts	Toledo-Sickles complex	980	0.3
Ve	Vestaburg loamy sand	4,555	1.3
Wa	Wauseon sandy loam	860	0.2
WxA	Wixom loamy sand, 0 to 2 percent slopes	1,520	0.4
	Water	1,830	0.5
	Total	362,240	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS

[Yields are those that can be expected under a high level of management. The estimates were made in 1976. Absence of a yield figure indicates the crop is seldom grown or the soil is not suited to the crop. Only arable soils are listed]

Soil name and map symbol	Corn	Corn silage	Oats	Wheat, winter	Soybeans	Grass-legume hay	Grass hay
	Bu	Ton	Bu	Bu	Bu	Ton	Ton
Adrian:							
Ad	75	10	---	---	23	---	2.4
Arkona:							
AkA	90	15	80	42	32	3.8	---
Arkport:							
ArB	90	18	70	40	28	3.5	---
ArC	70	14	55	38	---	3.0	---
Belleville:							
Be	80	13	60	38	33	4.0	---
Boyer:							
BoB	70	12	50	30	28	2.6	---
Capac:							
CaA	105	17	80	45	36	3.6	---
Ceresco:							
Ce	95	16	70	38	38	4.0	---
Cohoctah:							
Ch	---	---	---	---	---	3.0	---
Corunna:							
Cr	105	17	90	45	36	4.0	---
Dixboro:							
DxA	100	16	60	45	35	4.0	---
Gilford:							
Gd	90	16	55	45	30	3.8	---
Houghton:							
Ho	90	15	---	---	34	---	3.0
Huntington:							
HuB	100	---	70	45	37	3.0	---
Ithaca:							
ItA	110	18	90	50	40	4.2	---
Kingsville:							
Ke	75	---	70	30	---	3.0	---
Lamson:							
La	90	18	50	45	28	3.5	---
Lenawee:							
Le	105	17	75	48	38	3.0	---
Marlette:							
MaB	100	18	75	45	32	3.5	---
MaC	85	15	75	42	26	3.3	---
Metamora:							
[1]MeA	100	17	74	45	36	3.6	---
Metea:							
MtB	85	14	65	42	30	2.8	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Wheat, winter	Soybeans	Grass-legume hay	Grass hay
	Bu	Ton	Bu	Bu	Bu	Ton	Ton
Oakville:							
OaB	50	8	48	24	---	2.0	---
Olentangy:							
Oe	100	---	---	---	40	---	---
Palms:							
Pa	105	17	---	---	---	---	3.0
Parkhill:							
Ph	115	17	80	55	40	4.2	---
Perrinton:							
PkB	100	17	80	45	28	4.5	---
PkC	90	15	75	42	---	4.2	---
Pert:							
PlA	100	17	80	50	40	4.2	---
Pipestone:							
[1]PpA	70	---	---	---	---	3.0	---
[1]PrA	65	11	60	30	---	2.6	---
Plainfield:							
PtB	40	6	35	---	---	2.0	---
Riverdale:							
RdA	75	14	60	32	30	3.5	---
Selfridge:							
SeA	90	14	70	42	33	3.2	---
Sickles:							
Sk	90	15	70	40	30	4.2	---
Spinks:							
SpB	65	9	60	30	27	3.0	---
SpC	57	8	55	30	---	---	---
Tedrow:							
TdA	70	10	50	30	20	---	---
TeA	80	12	65	40	28	3.5	---
Thomas:							
Th	95	14	---	---	---	3.0	---
Tobico:							
Tm	70	13	55	35	23	---	2.6
Vestaburg:							
Ve	80	14	60	---	25	3.5	---
Wauseon:							
Wa	100	17	85	45	35	4.0	---
Wixom:							
WxA	95	16	80	45	35	3.8	---

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are not included. Absence of an entry means that no soil is in that class or subclass]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	---	---	---	---
II	210,875	21,520	189,355	---
III	112,535	13,525	87,195	11,815
IV	23,545	---	19,985	3,560
V	7,610	---	7,610	---
VI	4,670	---	3,445	1,225
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	Management concerns					Potential productivity		Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
Adrian:								
Ad	Slight	Severe	Severe	Severe	Severe	Red maple	46	---
						Silver maple	---	
						White ash	---	
						Quaking aspen	---	
Arkona:								
AkA	Slight	Moderate	Moderate	Slight	Slight	Quaking aspen	60	White spruce, Austrian pine, Norway spruce.
						Bigtooth aspen	---	
						Paper birch	---	
						White ash	---	
						Black cherry	---	
						Sugar maple	---	
						American basswood	---	
						Eastern white pine	---	
Arkport:								
ArB, ArC	Slight	Slight	Slight	Slight	Moderate	Sugar maple	61	Norway spruce, red pine, eastern white pine.
						Red pine	---	
						Eastern white pine	---	
Belleville:								
Be	Slight	Severe	Moderate	Moderate	Severe	Quaking aspen	44	---
						Red maple	---	
						Tamarack	---	
						Black ash	---	
Boyer:								
BoB	Slight	Slight	Slight	Slight	Moderate	Northern red oak	66	Eastern white pine, red pine, white spruce.
						White oak	---	
						American basswood	---	
						Sugar maple	---	
Capac:								
CaA	Slight	Moderate	Slight	Slight	Severe	Sugar maple	61	Eastern white pine, white spruce, Norway spruce.
						Northern red oak	---	
						American basswood	---	
						Paper birch	---	
						Quaking aspen	---	
						Black oak	---	
						Red maple	---	
						Yellow birch	---	
Capac Variant:								
[1]CcA:								
Capac Variant part	Slight	Moderate	Slight	Slight	Severe	Sugar maple	61	White spruce.
						Northern red oak	---	
						American basswood	---	
						Red maple	---	
						White oak	---	
Parkhill part	Slight	Severe	Severe	Moderate	Severe	Red maple	66	White spruce.
						Silver maple	---	
						White ash	---	
Ceresco:								
Ce	Slight	Moderate	Slight	Slight	Severe	Northern red oak	66	Eastern white pine, white spruce, eastern cottonwood.
						White ash	---	
						Red maple	---	
						Silver maple	---	
						Eastern cottonwood	---	
						American sycamore	---	
						Hackberry	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns					Potential productivity		Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
Cohoctah:								
Ch	Slight	Severe	Severe	Moderate	Severe	Red maple	66	Eastern cottonwood, white ash, white spruce, Austrian pine.
						Eastern cottonwood	---	
						Silver maple	---	
						White ash	---	
						Swamp white oak	---	
						American sycamore	---	
[1]Co:								
Cohoctah part	Slight	Severe	Severe	Moderate	Severe	Red maple	66	Eastern cottonwood, white spruce.
						Eastern cottonwood	---	
						Silver maple	---	
						White ash	---	
						Swamp white oak	---	
						American sycamore		
Ceresco part	Slight	Moderate	Slight	Slight	Severe	Northern red oak	66	Eastern white pine, white spruce, eastern cottonwood.
						White ash	---	
						Red maple	---	
						Silver maple	---	
						Eastern cottonwood	---	
						Hackberry	---	
Corunna:								
Cr	Slight	Severe	Moderate	Moderate	Severe	Red maple	56	Eastern cottonwood, white ash, eastern white pine, American sycamore.
						White ash	---	
						American basswood	---	
						Silver maple	---	
						Swamp white oak	---	
						Northern pin oak	---	
						Black oak	---	
						Swamp white oak	---	
Dixboro:								
DxA	Slight	Moderate	Slight	Slight	Moderate	Northern red oak	65	Eastern white pine, white spruce, poplar.
						White oak	---	
						Northern pin oak	---	
						Black oak	---	
						Shagbark hickory	---	
						Bitternut hickory	---	
						American basswood	---	
						Sugar maple	---	
Edwards:								
Ed	Slight	Severe	Severe	Severe	Severe	Red maple	46	---
						White ash	---	
						Green ash	---	
						Black cherry	---	
						Swamp white oak	---	
						Silver maple	---	
Gilford:								
Gd	Slight	Severe	Severe	Severe	Severe	Red maple	56	Eastern white pine, silver maple, Norway spruce, white spruce, eastern cottonwood.
						Silver maple	---	
						American basswood	---	
						White ash	---	
						Swamp white oak	---	
						Bur oak	---	
Houghton:								
Ho	Slight	Severe	Severe	Severe	Severe	Red maple	46	---
						Silver maple	---	
						White ash	---	
						Quaking aspen	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns					Potential productivity		Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
Huntington:								
HuB	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar	95	Yellow-poplar, black walnut, black locust, eastern white pine.
						Northern red oak	85	
Ithaca:								
ItA	Slight	Moderate	Slight	Slight	Moderate	Northern red oak	66	White spruce, Norway spruce, Austrian pine.
						Sugar maple	---	
						American basswood	---	
						White oak	---	
						Northern pin oak	---	
						Shagbark hickory	---	
Kingsville:								
Ke	Slight	Severe	Severe	Moderate	Severe	Quaking aspen	45	---
						Silver maple	---	
Lamson:								
La	Slight	Severe	Severe	Severe	Severe	Eastern white pine	54	Northern white-cedar, white ash.
						Red maple	56	
						Swamp white oak	---	
Lenawee:								
Le	Slight	Severe	Severe	Moderate	Severe	Red maple	70	White ash, Norway spruce, eastern white pine, northern white-cedar.
						White ash	71	
						American basswood	71	
						Silver maple	70	
Marlette:								
MaB, MaC	Slight	Slight	Slight	Slight	Severe	Sugar maple	61	White spruce, eastern cottonwood.
						Northern red oak	---	
						White ash	---	
						American basswood	---	
						Black cherry	---	
						White oak	---	
Martisco:								
Mc	Slight	Severe	Severe	Severe	Moderate	Red maple	46	---
Metamora:								
[1]MeA:								
Metamora part	Slight	Moderate	Slight	Slight	Severe	Northern red oak	66	White spruce, Norway spruce, eastern white pine, northern white-cedar.
						White ash	---	
						Bitternut hickory	---	
						Green ash	---	
						Shagbark hickory	---	
						American basswood	---	
						Sugar maple	---	
						Red maple	---	
Capac part	Slight	Moderate	Slight	Slight	Severe	Sugar maple	61	Eastern white pine, white spruce, Norway spruce.
						Northern red oak	---	
						American basswood	---	
						Paper birch	---	
						Quaking aspen	---	
						Black oak	---	
						Red maple	---	
						Yellow birch	---	
Metea:								
MtB	Slight	Slight	Moderate	Slight	Moderate	Northern red oak	66	Eastern white pine, red pine, black cherry, Austrian pine, European alder.
						White oak	---	
						Sugar maple	---	
						American basswood	---	
						Black cherry	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns					Potential productivity		Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
Metea Variant:								
MvB	Slight	Slight	Moderate	Slight	Moderate	Sugar maple	61	Red pine.
						Eastern white pine	---	
						Red pine	---	
						American basswood	---	
						Northern red oak	---	
						White ash	---	
						American beech	---	
Oakville:								
OaB	Slight	Slight	Severe	Slight	Moderate	Northern red oak	66	Red pine, eastern white pine, jack pine.
						White oak	---	
						Red pine	---	
						Quaking aspen	---	
						Black oak	---	
Olentangy:								
Oe	Slight	Severe	Severe	Severe	Severe	---	---	---
Palms:								
Pa	Slight	Severe	Severe	Severe	Severe	Red maple	46	---
						Silver maple	---	
						White ash	---	
						Quaking aspen	---	
Parkhill:								
Ph	Slight	Severe	Moderate	Moderate	Severe	Red maple	66	White spruce, eastern white pine, green ash, eastern cottonwood.
						Silver maple	---	
						White ash	---	
						American basswood	---	
						Quaking aspen	---	
Perrinton:								
PkB, PkC	Slight	Slight	Slight	Slight	Moderate	Northern red oak	66	White spruce, Norway spruce, red pine.
						Sugar maple	---	
						American elm	---	
						American beech	---	
						White ash	---	
						American basswood	---	
Pert:								
PlA	Slight	Slight	Slight	Slight	Moderate	Sugar maple	61	White spruce.
						Northern red oak	---	
						Silver maple	---	
						White oak	---	
						Quaking aspen	---	
						Paper birch	---	
Pipestone:								
[1]PpA:								
Pipestone part	Slight	Moderate	Severe	Slight	Slight	Quaking aspen	60	White spruce, eastern cottonwood, eastern white pine, Norway spruce.
						Bigtooth aspen	---	
						Eastern cottonwood	---	
						Northern red oak	---	
Tedrow part	Slight	Moderate	Moderate	Slight	Moderate	Eastern white pine	80	Eastern white pine, white spruce, Norway spruce.
						Northern red oak	75	
						Sugar maple	70	
[1]PrA:								
Pipestone part	Slight	Moderate	Moderate	Slight	Slight	Northern red oak	66	White spruce, eastern cottonwood, eastern white pine, Norway spruce.
						White ash	---	
						Shagbark hickory	---	
						Red maple	---	
						American basswood	---	
						Black ash	---	
						Eastern cottonwood	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns					Potential productivity		Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
Pipestone:								
[1]PrA: Tedrow part	Slight	Moderate	Moderate	Slight	Moderate	Quaking aspen	60	Eastern white pine,
						Swamp white oak	---	white spruce,
						Red maple	---	Norway spruce,
						Sugar maple	---	northern white-cedar,
						White ash	---	red maple.
						Eastern cottonwood	---	
						American basswood	---	
						Silver maple	---	
Plainfield:								
PtB	Slight	Slight	Severe	Slight	Moderate	Red pine	55	Red pine,
						Eastern white pine	---	eastern white pine,
						Jack pine	---	jack pine,
						Northern pin oak	---	black cherry.
Riverdale:								
RdA	Slight	Moderate	Moderate	Slight	Slight	Quaking aspen	60	White spruce,
						White ash	---	Norway spruce,
						Red maple	---	eastern white pine.
						Eastern cottonwood	---	
						Sugar maple	---	
						American basswood	---	
Selfridge:								
SeA	Slight	Moderate	Moderate	Slight	Moderate	Quaking aspen	60	Eastern white pine,
						American beech	---	Norway spruce,
						Black oak	---	black cherry,
						Red maple	---	Austrian pine.
						Sugar maple	---	
						Black cherry	---	
						American basswood	---	
Sickles:								
Sk	Slight	Severe	Severe	Severe	Severe	Quaking aspen	45	---
						Sugar maple	---	
						Northern white-cedar	---	
						American basswood	---	
						Red maple	---	
						Silver maple	---	
Sloan:								
Sn	Slight	Severe	Severe	Severe	Severe	Quaking aspen	45	White ash,
						Swamp white oak	---	Austrian pine.
						Red maple	---	
Spinks:								
SpB, SpC	Slight	Slight	Moderate	Slight	Moderate	Northern red oak	65	Red pine,
						White oak	65	eastern white pine,
						Shagbark hickory	65	jack pine,
						Eastern white pine	65	Scotch pine.
						Red pine	65	
Tedrow:								
TdA	Slight	Moderate	Moderate	Moderate	--------	Quaking aspen	60	Eastern white pine,
						Northern red oak	---	yellow-poplar,
						Sugar maple	---	white spruce,
						Eastern white pine	---	Norway spruce.
TeA	Slight	Moderate	Moderate	Slight	Moderate	Quaking aspen	60	Eastern white pine,
						Swamp white oak	---	white spruce,
						Red maple	---	Norway spruce,
						Sugar maple	---	northern white-cedar,
						White ash	---	red maple.
						Eastern cottonwood	---	
						American basswood	---	
						Silver maple	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns					Potential productivity		Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
Thomas:								
Th	Slight	Severe	Severe	Severe	Severe	Red maple	56	White spruce, Norway spruce, white ash.
						White ash	---	
						Black oak	---	
						American basswood	---	
						Silver maple	---	
						Black ash	---	
Tobico:								
Tm	Slight	Severe	Severe	Severe	Severe	Quaking aspen	45	---
						White ash	---	
						Eastern cottonwood	---	
Toledo:								
To	Slight	Severe	Severe	Severe	Severe	Quaking aspen	45	White spruce, eastern white pine.
						Swamp white oak	---	
[1]Ts:								
Toledo part	Slight	Severe	Severe	Severe	Severe	Quaking aspen	45	White spruce, eastern white pine.
						Swamp white oak	---	
Sickles part	Slight	Severe	Severe	Severe	Severe	Quaking aspen	45	---
						Sugar maple	---	
						Northern white-cedar	---	
						American basswood	---	
						Red maple	---	
						Silver maple	---	
Vestaburg:								
Ve	Slight	Severe	Severe	Severe	Severe	Quaking aspen	44	---
						Silver maple	---	
						Eastern cottonwood	---	
						Red maple	---	
Wauseon:								
Wa	Slight	Severe	Severe	Moderate	Severe	Red maple	66	White spruce.
Wixom:								
WxA	Slight	Moderate	Severe	Slight	Moderate	Quaking aspen	60	Eastern white pine, Norway spruce, black cherry, Austrian pine.
						American beech	---	
						White oak	---	
						Red maple	---	
						Sugar maple	---	
						Black cherry	---	
						American basswood	---	

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[Only soils suited to windbreaks are listed. Absence of an entry means the species does not grow well on the soil]

Soil name and map symbol	Expected heights of specified trees at 20 years of age								
	Norway spruce	Eastern redcedar	Autumn-olive	American mountain-ash	Red pine	Blue spruce	Northern white-cedar	Austrian pine	Scotch pine
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
Adrian:									
Ad	--	--	--	--	--	--	29	22	31
Arkona:									
AkA	26	14	11	25	--	9	23	22	23
Arkport:									
ArB, ArC	24	20	13	28	25	14	--	23	30
Belleville:									
Be	25	--	--	--	--	--	21	--	21
Boyer:									
BoB	21	20	10	23	30	9	--	23	30
Capac:									
CaA	26	14	11	25	--	9	23	24	23
Capac Variant:									
[1]CcA:									
Capac Variant part	25	13	10	24	25	8	23	23	21
Parkhill part	25	--	--	--	--	--	23	--	21
Ceresco:									
Ce	25	14	11	25	--	9	23	24	23
Cohoctah:									
Ch	--	--	--	--	--	--	23	--	21
[1]Co:									
Cohoctah part	--	--	--	--	--	--	23	--	--
Ceresco part	25	12	9	23	--	8	23	21	28
Corunna:									
Cr	25	--	--	--	--	--	21	--	21
Dixboro:									
DxA	25	13	10	24	--	8	21	23	21
Gilford:									
Gd	24	--	--	--	--	--	20	--	20
Huntington:									
HuB	26	22	15	30	--	16	19	25	31
Ithaca:									
ItA	26	14	11	25	26	9	23	24	23
Kingsville:									
Ke	--	--	--	--	--	--	18	--	18
Lamson:									
La	24	--	--	--	--	--	20	--	20
Lenawee:									
Le	25	--	--	--	--	--	21	--	21
Marlette:									
MaB, MaC	26	14	13	22	24	9	23	23	23

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Expected heights of specified trees at 20 years of age								
	Norway spruce	Eastern redcedar	Autumn-olive	American mountain-ash	Red pine	Blue spruce	Northern white-cedar	Austrian pine	Scotch pine
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
Metamora:									
[1]MeA:									
Metamora part	26	14	11	25	--	9	23	24	23
Capac part	26	14	11	25	--	9	23	24	23
Metea:									
MtB	26	20	15	28	22	14	--	22	30
Metea Variant:									
MvB	23	19	12	22	24	12	--	21	28
Oakville:									
OaB	20	18	9	21	30	8	--	20	31
Parkhill:									
Ph	26	--	--	--	--	--	23	--	21
Perrinton:									
PkB, PkC	26	14	8	25	30	9	23	25	23
Pert:									
PlA	26	14	11	25	--	9	22	22	21
Pipestone:									
[1]PpA:									
Pipestone part	21	11	10	22	--	9	19	22	23
Tedrow part	21	11	10	22	--	9	19	22	23
[1]PrA:									
Pipestone part	26	12	11	23	--	8	23	22	22
Tedrow part	26	12	11	23	26	8	23	24	22
Plainfield:									
PtB, PtC	20	16	8	20	30	7	--	18	31
Riverdale:									
RdA	21	11	10	22	--	8	19	21	23
Saranac:									
Sa	23	--	--	--	--	--	21	21	--
Selfridge:									
SeA	26	14	11	25	--	9	23	24	23
Sickles:									
Sk	23	--	--	--	--	--	21	--	20
Sloan:									
Sn	25	9	8	--	--	--	21	--	21
Spinks:									
SpB, SpC	21	11	15	22	--	8	19	21	23
Tedrow:									
TdA	21	11	10	22	--	8	19	22	23
TeA	26	12	10	23	--	8	23	24	22
Thomas:									
Th	--	--	--	--	--	--	21	--	25

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Expected heights of specified trees at 20 years of age								
	Norway spruce	Eastern redcedar	Autumn-olive	American mountain-ash	Red pine	Blue spruce	Northern white-cedar	Austrian pine	Scotch pine
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
Tobico:									
Tm	--	--	--	--	--	--	21	--	25
Toledo:									
To	23	--	--	--	--	--	20	--	19
[1]Ts:									
Toledo part	23	--	--	--	--	--	20	--	19
Sickles part	23	--	--	--	--	--	21	--	19
Vestaburg:									
Ve	--	--	--	--	--	--	21	--	21
Wauseon:									
Wa	25	--	--	--	--	--	21	--	21
Wixom:									
WxA	26	14	11	25	--	9	23	24	23

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole 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
Adrian:					
Ad	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods, frost action.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.
Arkona:					
AkA	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: low strength, shrink-swell.
Arkport:					
ArB	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.
ArC	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength.
Belleville:					
Be	Severe: wetness, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.
Boyer:					
BoB	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Capac:					
CaA	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.
Capac Variant:					
[1]CcA:					
Capac Variant part	Severe: wetness, small stones.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.
Parkhill part	Severe: wetness, floods.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: frost action, floods, wetness.
Ceresco:					
Ce	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.
Cohoctah:					
Ch	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods, frost action.

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
Cohoctah:					
[1]Co:					
Cohoctah part	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods, frost action.
Ceresco part	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.
Corunna:					
Cr	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.
Dixboro:					
DxA	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.
Edwards:					
Ed	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.
Gilford:					
Gd	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.
Houghton:					
Ho	Severe: wetness, floods, cutbanks cave.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, frost action, low strength.
Huntington:					
HuB	Slight	Slight	Slight	Slight	Severe: frost action.
Ithaca:					
ItA	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.
Kingsville:					
Ke	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Lamson:					
La	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.
Lenawee:					
Le	Severe: wetness.	Severe: low strength, wetness.	Severe: low strength, wetness.	Severe: low strength, wetness.	Severe: frost action, low strength, wetness.

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
Marlette:					
MaB	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: frost action, low strength.
MaC	Moderate: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, frost action, low strength.
Martisco:					
Mc	Severe: wetness, excess humus, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Metamora:					
[1]MeA:					
Metamora part	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.
Capac part	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.
Metea:					
MtB	Slight	Slight	Slight	Slight	Moderate: frost action, low strength.
Metea Variant:					
MvB	Severe: small stones.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: shrink-swell.
Oakville:					
OaB	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Olentangy:					
Oe	Severe: wetness, excess humus.	Severe: wetness, excess humus, low strength.	Severe: wetness, excess humus, low strength.	Severe: wetness, excess humus, low strength.	Severe: wetness, excess humus, low strength.
Palms:					
Pa	Severe: wetness, excess humus, cutbanks cave.	Severe: wetness, frost action, excess humus.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.
Parkhill:					
Ph	Severe: wetness, floods.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: frost action, floods, wetness.
Perrinton:					
PkB	Moderate: wetness, too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, wetness.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, frost action, low strength.
PkC	Moderate: wetness, too clayey, slope.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, wetness.	Severe: slope.	Moderate: shrink-swell, frost action, low strength.

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
Pert:					
PlA	Severe: wetness.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: frost action, shrink-swell, low strength.
Pipestone:					
[1]PpA:					
Pipestone part	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.
Tedrow part	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.
[1]PrA:					
Pipestone part	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.
Tedrow part	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.
Pits:					
Ps.					
Plainfield:					
PtB	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
PtC	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Riverdale:					
RdA	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.
Saranac:					
Sa	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.
Selfridge:					
SeA	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.
Sickles:					
Sk	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness, low strength.	Severe: wetness.	Severe: wetness, low strength.
Sloan:					
Sn	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.
Spinks:					
SpB	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
SpC	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.

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
Tedrow:					
TdA	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.
TeA	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.
Thomas:					
Th	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.
Tobico:					
Tm	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Toledo:					
To	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.
[1]Ts:					
Toledo part	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.
Sickles part	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness, low strength.	Severe: wetness.	Severe: wetness, low strength.
Vestaburg:					
Ve	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Wauseon:					
Wa	Severe: wetness.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.
Wixom:					
WxA	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Moderate: wetness, shrink-swell, frost action.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole 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," "good," and "fair." Absence of an entry means 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
Adrian:					
Ad	Severe: wetness, floods.	Severe: wetness, excess humus, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: excess humus, hard to pack.
Arkona:					
AkA	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: too sandy.
Arkport:					
ArB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
ArC	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope, too sandy.
Belleville:					
Be	Severe: wetness, percs slowly, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Poor: wetness, too sandy.
Boyer:					
BoB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Capac:					
CaA	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
Capac Variant:					
[1]CcA:					
Capac Variant part	Severe: wetness, percs slowly.	Severe: wetness, small stones.	Severe: wetness, small stones.	Severe: wetness.	Poor: small stones, wetness.
Parkhill part	Severe: wetness, percs slowly, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Ceresco:					
Ce	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Fair: thin layer.
Cohoctah:					
Ch	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness.
[1]Co:					
Cohoctah part	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, 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
Cohoctah:					
Ceresco part	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Fair: thin layer.
Corunna:					
Cr	Severe: wetness, percs slowly, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Dixboro:					
DxA	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
Edwards:					
Ed	Severe: floods, wetness.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, seepage.	Poor: excess humus, wetness, hard to pack.
Gilford:					
Gd	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Poor: wetness.
Houghton:					
Ho	Severe: wetness, floods.	Severe: wetness, excess humus, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: excess humus, hard to pack.
Huntington:					
HuB	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
Ithaca:					
ItA	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, hard to pack.
Kingsville:					
Ke	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
Lamson:					
La	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness.
Lenawee:					
Le	Severe: percs slowly, wetness.	Slight	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Marlette:					
MaB	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
MaC	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.

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
Martisco:					
Mc	Severe: wetness, percs slowly, floods.	Severe: wetness, excess humus, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, excess humus.
Metamora:					
[1]MeA:					
Metamora part	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
Capac part	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
Metea:					
MtB	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: too sandy.
Metea Variant:					
MvB	Moderate: percs slowly.	Severe: seepage, small stones.	Severe: seepage.	Severe: seepage.	Poor: small stones, seepage.
Oakville:					
OaB	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Olentangy:					
Oe	Severe: wetness.	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: wetness.	Poor: wetness, excess humus.
Palms:					
Pa	Severe: wetness, floods.	Severe: wetness, excess humus, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: excess humus, hard to pack.
Parkhill:					
Ph	Severe: wetness, percs slowly, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, too clayey.
Perrinton:					
PkB	Severe: percs slowly.	Moderate: wetness, slope.	Moderate: too clayey, wetness.	Moderate: wetness.	Fair: too clayey.
PkC	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, wetness.	Moderate: wetness, slope.	Fair: too clayey, slope.
Pert:					
PlA	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.
Pipestone:					
[1]PpA:					
Pipestone part	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: too sandy, seepage.

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
Pipestone:					
[1]PpA:					
Tedrow part	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
[1]PrA:					
Pipestone part	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: seepage, wetness.	Poor: too sandy.
Tedrow part	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: too sandy, seepage.
Pits:					
Ps.					
Plainfield:					
PtB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
PtC	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
Riverdale:					
RdA	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, too sandy, seepage.	Severe: wetness, seepage.	Fair: area reclaim, too sandy.
Saranac:					
Sa	Severe: wetness, percs slowly, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, too clayey.
Selfridge:					
SeA	Severe: percs slowly, wetness.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: too sandy.
Sickles:					
Sk	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness, too sandy, seepage.
Sloan:					
Sn	Severe: wetness, floods, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Spinks:					
SpB	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
SpC	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
Tedrow:					
TdA	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.

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
Tedrow:					
TeA	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: too sandy, seepage.
Thomas:					
Th	Severe: wetness, percs slowly, floods.	Severe: wetness, excess humus.	Severe: wetness, floods.	Severe: wetness.	Poor: wetness.
Tobico:					
Tm	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Poor: wetness, seepage, too sandy.
Toledo:					
To	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
[1]Ts:					
Toledo part	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
Sickles part	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness, too sandy, seepage.
Vestaburg:					
Ve	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Poor: wetness, too sandy.
Wauseon:					
Wa	Severe: percs slowly, wetness.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
Wixom:					
WxA	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole 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
Adrian:				
Ad	Poor: excess humus, wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
Arkona:				
AkA	Poor: thin layer.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
Arkport:				
ArB, ArC	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
Belleville:				
Be	Poor: wetness, thin layer.	Poor: thin layer.	Unsuited: excess fines.	Poor: wetness.
Boyer:				
BoB	Good	Good	Good	Fair: too sandy.
Capac:				
CaA	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Capac Variant:				
[1]CcA:				
Capac Variant part	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
Parkhill part	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Ceresco:				
Ce	Poor: wetness.	Fair: excess fines.	Good	Good.
Cohoctah:				
Ch	Poor: wetness.	Fair: excess fines.	Good	Poor: wetness.
[1]Co:				
Cohoctah part	Poor: wetness.	Fair: excess fines.	Good	Poor: wetness.
Ceresco part	Poor: wetness.	Fair: excess fines.	Good	Good.
Corunna:				
Cr	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Dixboro:				
DxA	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Good.
Edwards:				
Ed	Poor: excess humus, wetness.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Gilford:				
Gd	Poor: wetness.	Fair: excess fines.	Good	Poor: wetness.
Houghton:				
Ho	Poor: wetness, low strength.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.
Huntington:				
HuB	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ithaca:				
ItA	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Kingsville:				
Ke	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
Lamson:				
La	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
Lenawee:				
Le	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Marlette:				
MaB, MaC	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Martisco:				
Mc	Poor: wetness, excess humus.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.
Metamora:				
[1]MeA:				
Metamora part	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Capac part	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Metea:				
MtB	Fair: low strength.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
Metea Variant:				
MvB	Fair: shrink-swell.	Unsuited: excess fines.	Poor: excess fines.	Poor: small stones.
Oakville:				
OaB	Good	Good	Unsuited: excess fines.	Poor: too sandy.
Olentangy:				
Oe	Poor: wetness, excess humus, low strength.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.
Palms:				
Pa	Poor: wetness, excess humus.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Parkhill:				
Ph	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Perrinton:				
PkB	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
PkC	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
Pert:				
PlA	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Pipestone:				
[1]PpA:				
Pipestone part	Poor: wetness.	Good	Unsuited: excess fines.	Fair: too sandy.
Tedrow part	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
[1]PrA:				
Pipestone part	Poor: wetness.	Fair: thin layer.	Unsuited: excess fines.	Fair: too sandy.
Tedrow part	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
Pits:				
Ps.				
Plainfield:				
PtB, PtC	Good	Good	Unsuited: excess fines.	Fair: too sandy.
Riverdale:				
RdA	Poor: wetness.	Good	Good	Fair: too sandy.
Saranac:				
Sa	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, too clayey.
Selfridge:				
SeA	Poor: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
Sickles:				
Sk	Poor: shrink-swell, wetness, low strength.	Poor: thin layer.	Unsuited: excess fines.	Poor: wetness.
Sloan:				
Sn	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Spinks:				
SpB, SpC	Good	Good	Unsuited: excess fines.	Fair: too sandy.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Tedrow:				
TdA	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
TeA	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
Thomas:				
Th	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Tobico:				
Tm	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness.
Toledo:				
To	Poor: low strength, wetness, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
[1]Ts:				
Toledo part	Poor: low strength, wetness, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Sickles part	Poor: shrink-swell, wetness.	Poor: thin layer.	Unsuited: excess fines.	Poor: wetness.
Vestaburg:				
Ve	Poor: wetness.	Good	Good	Poor: wetness.
Wauseon:				
Wa	Poor: wetness, low strength.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: wetness.
Wixom:				
WxA	Fair: wetness, shrink-swell, low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole 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	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
Adrian:						
Ad	Seepage	Wetness, seepage, excess humus.	Slow refill	Floods, frost action.	Wetness, soil blowing, floods.	Wetness.
Arkona:						
AkA	Seepage	Seepage, wetness.	Slow refill	Favorable	Fast intake, soil blowing, wetness.	Wetness.
Arkport:						
ArB	Seepage	Seepage, piping.	No water	Not needed	Fast intake, soil blowing.	Droughty.
ArC	Seepage, slope.	Seepage, piping.	No water	Not needed	Fast intake, soil blowing, slope.	Droughty, slope.
Belleville:						
Be	Seepage	Piping, wetness.	Slow refill	Frost action, poor outlets.	Wetness, fast intake, floods.	Wetness.
Boyer:						
BoB	Seepage	Seepage	No water	Not needed	Soil blowing, fast intake.	Droughty.
Capac:						
CaA	Seepage	Piping, wetness.	Slow refill	Frost action	Wetness	Wetness.
Capac Variant:						
[1]CcA:						
Capac Variant part	Seepage	Wetness	Slow refill	Frost action	Wetness	Wetness.
Parkhill part	Favorable	Wetness	Slow refill	Frost action, poor outlets.	Wetness, slow intake, percs slowly.	Wetness.
Ceresco:						
Ce	Seepage	Wetness, seepage.	Deep to water	Poor outlets, floods, frost action.	Floods, wetness.	Wetness.
Cohoctah:						
Ch	Seepage	Piping, seepage, wetness.	Favorable	Poor outlets, floods, frost action.	Wetness, floods.	Wetness.
[1]Co:						
Cohoctah part	Seepage	Piping, seepage, wetness.	Favorable	Poor outlets, floods, frost action.	Wetness, floods.	Wetness.
Ceresco part	Seepage	Wetness, seepage.	Deep to water	Poor outlets, floods, frost action.	Floods, wetness.	Wetness.
Corunna:						
Cr	Favorable	Wetness	Slow refill	Frost action, poor outlets.	Wetness, floods.	Wetness.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
Dixboro:						
DxA----------------	Seepage--------	Piping, wetness.	Deep to water	Frost action---	Wetness, soil blowing.	Wetness.
Edwards:						
Ed-----------------	Seepage--------	Excess humus, wetness.	Slow refill----	Frost action, poor outlets, excess humus.	Floods, soil blowing, wetness.	Wetness.
Gilford:						
Gd-----------------	Seepage--------	Seepage, wetness.	Favorable------	Frost action---	Wetness, soil blowing, floods.	Wetness.
Houghton:						
Ho-----------------	Seepage--------	Excess humus, wetness.	Slow refill----	Frost action, poor outlets, excess humus.	Wetness, soil blowing, floods.	Wetness.
Huntington:						
HuB----------------	Seepage--------	Piping---------	Deep to water, slow refill.	Not needed-----	Floods---------	Favorable.
Ithaca:						
ItA----------------	Favorable------	Wetness--------	Slow refill----	Frost action---	Wetness--------	Wetness.
Kingsville:						
Ke-----------------	Seepage--------	Seepage, piping, wetness.	Favorable------	Favorable------	Fast intake, floods, wetness.	Wetness.
Lamson:						
La-----------------	Seepage--------	Piping, wetness.	Favorable------	Frost action, poor outlets.	Wetness, floods.	Wetness.
Lenawee:						
Le-----------------	Seepage--------	Wetness--------	Slow refill----	Frost action---	Floods, wetness.	Wetness.
Marlette:						
MaB----------------	Seepage--------	Favorable------	No water-------	Not needed-----	Favorable------	Favorable.
MaC----------------	Seepage, slope.	Favorable------	No water-------	Not needed-----	Slope----------	Slope.
Martisco:						
Mc-----------------	Favorable------	Excess humus, wetness.	Slow refill----	Percs slowly, poor outlets, frost action.	Wetness, percs slowly, floods.	Wetness.
Metamora:						
[1]MeA:						
Metamora part--	Seepage--------	Wetness--------	Slow refill----	Frost action---	Soil blowing, wetness.	Wetness.
Capac part-----	Seepage--------	Wetness--------	Slow refill----	Frost action---	Wetness, soil blowing.	Wetness.
Metea:						
MtB----------------	Seepage--------	Favorable------	No water-------	Not needed-----	Droughty, fast intake, soil blowing.	Droughty.
Metea Variant:						
MvB----------------	Seepage--------	Favorable------	No water-------	Not needed-----	Droughty, fast intake.	Droughty.
Oakville:						
OaB----------------	Seepage--------	Seepage--------	No water-------	Not needed-----	Fast intake, soil blowing.	Droughty.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
Olentangy:						
Oe	Favorable	Wetness, excess humus.	Slow refill	Frost action, poor outlets.	Soil blowing, wetness, floods.	Wetness.
Palms:						
Pa	Seepage	Excess humus, wetness.	Slow refill	Frost action, floods, excess humus.	Wetness, soil blowing, floods.	Wetness.
Parkhill:						
Ph	Seepage	Wetness	Slow refill	Frost action, poor outlets.	Wetness, floods.	Wetness.
Perrinton:						
PkB	Favorable	Wetness	Slow refill	Not needed	Wetness	Favorable.
PkC	Slope	Wetness	Slow refill	Not needed	Slope, wetness.	Slope.
Pert:						
PlA	Favorable	Wetness, hard to pack.	Slow refill	Frost action, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Pipestone:						
[1]PpA:						
Pipestone part	Seepage	Seepage, wetness.	Favorable	Favorable	Fast intake, soil blowing, wetness.	Droughty, wetness.
Tedrow part	Seepage	Seepage, wetness.	Favorable	Favorable	Fast intake, wetness, soil blowing.	Wetness, droughty.
[1]PrA:						
Pipestone part	Seepage	Wetness, seepage.	Favorable	Favorable	Fast intake, wetness, soil blowing.	Droughty, wetness.
Tedrow part	Seepage	Seepage, wetness.	Favorable	Favorable	Soil blowing, wetness, fast intake.	Wetness.
Pits:						
Ps.						
Plainfield:						
PtB, PtC	Seepage	Seepage	No water	Not needed	Droughty, fast intake, soil blowing.	Droughty.
Riverdale:						
RdA	Seepage	Seepage, piping, wetness.	Deep to water	Favorable	Wetness, fast intake, soil blowing.	Droughty, wetness.
Saranac:						
Sa	Favorable	Hard to pack, wetness.	Slow refill	Poor outlets, floods, frost action.	Wetness, floods.	Wetness.
Selfridge:						
SeA	Seepage	Wetness	Slow refill	Wetness, frost action.	Wetness, fast intake.	Wetness.
Sickles:						
Sk	Seepage	Wetness	Slow refill	Percs slowly, floods.	Wetness, fast intake.	Wetness.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
Sloan:						
Sn	Favorable	Piping, wetness.	Slow refill	Frost action, floods, poor outlets.	Wetness, floods.	Wetness.
Spinks:						
SpB, SpC	Seepage	Seepage	No water	Not needed	Droughty, fast intake, soil blowing.	Droughty.
Tedrow:						
TdA	Seepage	Seepage, piping, wetness.	Favorable	Favorable	Fast intake, soil blowing, wetness.	Wetness, droughty.
TeA	Seepage	Seepage, piping, wetness.	Favorable	Favorable	Soil blowing, wetness, fast intake.	Wetness, droughty.
Thomas:						
Th	Favorable	Wetness	Slow refill	Frost action, poor outlets, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Tobico:						
Tm	Seepage	Seepage, piping.	Favorable	Floods, poor outlets.	Wetness, soil blowing, floods.	Wetness.
Toledo:						
To	Favorable	Wetness, hard to pack.	Slow refill	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.
[1]Ts:						
Toledo part	Favorable	Wetness, hard to pack.	Slow refill	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.
Sickles part	Seepage	Wetness	Slow refill	Percs slowly, floods.	Wetness, fast intake, percs slowly.	Wetness, percs slowly.
Vestaburg:						
Ve	Seepage	Seepage, wetness.	Favorable	Favorable	Wetness, fast intake.	Wetness.
Wauseon:						
Wa	Favorable	Piping, wetness.	Slow refill	Percs slowly	Wetness, percs slowly.	Wetness.
Wixom:						
WxA	Favorable	Wetness	Slow refill	Favorable	Droughty, fast intake.	Droughty, wetness.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole 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
Adrian:				
Ad	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.
Arkona:				
AkA	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
Arkport:				
ArB	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
ArC	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Belleville:				
Be	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Boyer:				
BoB	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Capac:				
CaA	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Capac Variant:				
[1]CcA:				
Capac Variant part	Severe: small stones, wetness.	Severe: small stones.	Severe: small stones, wetness.	Severe: small stones.
Parkhill part	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, small stones, floods.	Severe: wetness, floods.
Ceresco:				
Ce	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods, wetness.	Moderate: wetness, floods.
Cohoctah:				
Ch	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
[1]Co:				
Cohoctah part	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Cohoctah:				
Ceresco part	Severe: wetness, floods.	Moderate: wetness, floods.	Severe: floods, wetness.	Moderate: wetness, floods.
Corunna:				
Cr	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Dixboro:				
DxA	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Edwards:				
Ed	Severe: floods, wetness, excess humus.	Severe: dusty, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: dusty, wetness, excess humus.
Gilford:				
Gd	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Houghton:				
Ho	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.
Huntington:				
HuB	Slight	Slight	Moderate: slope.	Slight.
Ithaca:				
ItA	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Kingsville:				
Ke	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Lamson:				
La	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Lenawee:				
Le	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Marlette:				
MaB	Slight	Slight	Moderate: slope.	Slight.
MaC	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Martisco:				
Mc	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
Metamora:				
[1]MeA:				
Metamora part	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Metamora:				
Capac part	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Metea:				
MtB	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Metea Variant:				
MvB	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.
Oakville:				
OaB	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy.	Severe: too sandy.
Olentangy:				
Oe	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus.	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus.
Palms:				
Pa	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.
Parkhill:				
Ph	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Perrinton:				
PkB	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
PkC	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight.
Pert:				
PlA	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Pipestone:				
[1]PpA:				
Pipestone part	Severe: wetness.	Moderate: too sandy.	Severe: wetness.	Moderate: too sandy.
Tedrow part	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
[1]PrA:				
Pipestone part	Severe: wetness.	Moderate: too sandy.	Severe: wetness.	Moderate: too sandy.
Tedrow part	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: too sandy, wetness.
Pits:				
Ps.				

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Plainfield:				
PtB	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
PtC	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.
Riverdale:				
RdA	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
Saranac:				
Sa	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Selfridge:				
SeA	Moderate: too sandy, wetness.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.
Sickles:				
Sk	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Sloan:				
Sn	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Spinks:				
SpB	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
SpC	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Tedrow:				
TdA	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, too sandy.
TeA	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: too sandy, wetness.
Thomas:				
Th	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: wetness, excess humus.
Tobico:				
Tm	Severe: floods, wetness, excess humus.	Severe: excess humus, wetness.	Severe: floods, excess humus, wetness.	Severe: excess humus, wetness.
Toledo:				
To	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Toledo:				
[1]Ts:				
Toledo part	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Sickles part	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Vestaburg:				
Ve	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Wauseon:				
Wa	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Wixom:				
WxA	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole 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: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
Adrian: Ad	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Arkona: AkA	Poor	Poor	Good	Fair	Fair	Poor	Fair	Fair	Fair	Fair.
Arkport: ArB	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ArC	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Belleville: Be	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair.
Boyer: BoB	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Capac: CaA	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Capac Variant: [1]CcA: Capac Variant part	Fair	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Parkhill part	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ceresco: Ce	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Cohoctah: Ch	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
[1]Co: Cohoctah part	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ceresco part	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Corunna: Cr	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Dixboro: DxA	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Edwards: Ed	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
Gilford: Gd	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Houghton: Ho	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Huntington: HuB	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ithaca: ItA	Fair	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
Kingsville:										
Ke	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Lamson:										
La	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Lenawee:										
Le	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Marlette:										
MaB	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MaC	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Martisco:										
Mc	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Metamora:										
[1]MeA:										
Metamora part	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Capac part	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Metea:										
MtB	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Metea Variant:										
MvB	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Oakville:										
OaB	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Olentangy:										
Oe	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Poor.
Palms:										
Pa	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
Parkhill:										
Ph	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Perrinton:										
PkB	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PkC	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Pert:										
PlA	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Pipestone:										
[1]PpA:										
Pipestone part	Fair	Poor	Fair	Poor	Poor	Fair	Poor	Fair	Poor	Poor.
Tedrow part	Poor	Fair	Fair	Poor	Poor	Fair	Poor	Fair	Poor	Poor.
[1]PrA:										
Pipestone part	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
Tedrow part	Poor	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
Pits:										
Ps.										
Plainfield:										
PtB	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
PtC	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Riverdale:										
RdA	Poor	Fair	Good	Fair	Fair	Fair	Poor	Fair	Fair	Poor.
Saranac:										
Sa	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Selfridge:										
SeA	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Sickles:										
Sk	Fair	Fair	Poor	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
Sloan:										
Sn	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Spinks:										
SpB	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
SpC	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Tedrow:										
TdA	Poor	Fair	Fair	Poor	Poor	Fair	Poor	Fair	Poor	Poor.
TeA	Poor	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Thomas:										
Th	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Tobico:										
Tm	Very poor.	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
Toledo:										
To	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
[1]Ts:										
Toledo part	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Sickles part	Fair	Fair	Poor	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
Vestaburg:										
Ve	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor	Poor.
Wauseon:										
Wa	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wixom:										
WxA	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole 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: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Adrian:											
Ad	0-34	Sapric material	Pt	---	---	---	---	---	---	---	---
	34-60	Sand, loamy sand	SP, SM	A-2, A-3	0	100	90-100	50-75	0-20	---	[1]NP
Arkona:											
AkA	0-12	Loamy sand	SM	A-2-4	0	100	95-100	55-80	20-35	---	NP
	12-35	Sand, loamy sand, loamy fine sand.	SP, SM	A-2-4, A-3	0	100	95-100	50-75	0-35	---	NP
	35-60	Silty clay, clay, silty clay loam.	CH	A-7	0	100	90-100	90-100	75-95	51-70	25-40
Arkport:											
ArB, ArC	0-9	Loamy fine sand	SM	A-2, A-4	0	90-100	90-100	65-85	20-45	---	NP
	9-22	Very fine sandy loam, loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	90-100	90-100	70-95	30-65	<15	NP-4
	22-60	Very fine sand, loamy fine sand, loamy very fine sand.	SM, ML	A-2, A-4	0	90-100	90-100	65-95	20-60	---	NP
Belleville:											
Be	0-8	Loamy sand	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
	8-35	Fine sand, loamy sand, loamy fine sand.	SM	A-2	0-3	95-100	90-100	50-85	15-30	<20	NP-4
	35-60	Clay loam, silty clay loam.	CL	A-6, A-7	0-3	95-100	90-100	90-100	70-90	25-50	10-25
Boyer:											
BoB	0-18	Loamy sand	SM, SM-SC	A-2	0-5	95-100	65-95	45-75	15-30	<20	NP-6
	18-24	Sandy loam, sandy clay loam, loamy sand.	SM, SC	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	24-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
Capac:											
CaA	0-8	Loam	SM, CL, ML, SC	A-4	0-5	95-100	90-100	70-95	40-75	18-30	3-10
	8-28	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	85-100	50-80	25-40	5-20
	28-60	Loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-75	15-35	5-15
Capac Variant:											
[2]CcA:											
Capac Variant part	0-14	Cobbly sandy loam.	ML, SM, SC	A-2, A-4	20-60	80-90	75-85	40-80	30-60	10-30	NP-10
	14-25	Cobbly clay loam, cobbly sandy clay loam.	SM-SC, SC	A-4, A-2, A-6	20-60	60-90	55-75	40-75	20-40	15-35	5-25
	25-60	Loam	CL, CL-ML	A-4, A-6	0-10	90-100	85-100	70-95	51-75	25-35	5-15

See footnotes 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	
Capac Variant:											
Parkhill part---	0-7	Gravelly sandy loam.	ML, SM, CL, SC	A-4	5-20	80-95	75-90	70-90	40-70	18-32	3-10
	7-44	Clay loam, sandy clay loam, gravelly clay loam.	CL	A-4, A-6	0-10	85-95	80-95	85-100	51-80	25-40	9-25
	44-60	Loam------------	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	80-95	60-75	15-35	5-15
Ceresco:											
Ce----------------	0-11	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	100	60-90	30-75	10-20	NP-6
	11-38	Sandy loam, fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	95-100	60-85	15-60	10-30	NP-8
	38-60	Gravelly sand---	SP, GP, SP-SM, GP-GM	A-1, A-3	0-10	40-90	35-85	30-60	0-10	---	NP
Cohoctah:											
Ch----------------	0-12	Fine sandy loam	ML, SM	A-4, A-2	0	100	100	65-95	30-75	20-30	NP-6
	12-37	Loam, fine sandy loam, sandy loam.	ML, SM, CL, SC	A-4, A-2	0	100	100	70-90	30-70	20-30	NP-10
	37-60	Sand, gravelly coarse sand, gravelly sand.	SP-SM, SP, GP, GP-GM	A-1, A-3	0-10	40-90	35-85	30-60	0-10	---	NP
[2]Co:											
Cohoctah part---	0-12	Fine sandy loam	ML, SM	A-4, A-2	0	100	100	65-95	30-75	20-30	NP-6
	12-37	Loam, fine sandy loam, sandy loam.	ML, SM, CL, SC	A-4, A-2	0	100	100	70-90	30-70	20-30	NP-10
	37-60	Sand, gravelly coarse sand, gravelly sand.	SP-SM, SP, GP, GP-GM	A-1, A-3	0-10	40-90	35-85	30-60	0-10	---	NP
Ceresco part----	0-11	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	100	60-90	30-75	10-20	NP-6
	11-38	Sandy loam, fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	95-100	60-85	15-60	10-30	NP-8
	38-60	Gravelly sand---	SP, GP, SP-SM, GP-GM	A-1, A-3	0-10	40-90	35-85	30-60	0-10	---	NP
Corunna:											
Cr----------------	0-9	Sandy loam------	SM, ML, SC, CL	A-2, A-4	0-5	95-100	95-100	65-85	25-70	<30	NP-10
	9-31	Sandy loam, loamy sand.	SM, SC	A-4, A-2	0-5	95-100	95-100	50-75	15-40	<30	NP-10
	31-60	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	70-90	25-50	11-25
Dixboro:											
DxA---------------	0-15	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	100	70-95	40-65	<20	2-6
	15-38	Fine sandy loam, silt loam, loam.	SM, ML, SC, CL	A-4	0	100	100	70-95	40-90	<25	2-10
	38-60	Stratified fine sand to silt loam.	SM, ML, SC, CL	A-2-4, A-4	0	100	95-100	70-95	20-80	<20	NP-8

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Edwards:											
Ed	0-35	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	35-60	Marl	---	---	0	100	95-100	80-90	60-80	---	---
Gilford:											
Gd	0-11	Sandy loam	SC, SM	A-4, A-2-4	0	95-100	90-100	60-70	30-40	20-30	2-10
	11-29	Sandy loam, fine sandy loam.	SM, SC	A-2-4	0	90-100	90-100	55-70	25-35	20-30	NP-8
	29-40	Coarse sand, sand, loamy sand.	SM, SP	A-3, A-1-b	0	90-100	85-100	18-60	3-18	---	NP
	40-60	Gravelly sand	SP, SP-SM	A-1, A-3	5-15	80-95	75-90	40-60	3-10	---	NP
Houghton:											
Ho	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
Huntington:											
HuB	0-11	Silt loam	ML, CL	A-4, A-6	0	95-100	95-100	85-100	60-95	25-35	5-15
	11-55	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6	0	95-100	95-100	85-100	60-95	25-35	5-15
	55-60	Stratified fine sandy loam to loam.	SM, SC, ML, CL	A-2, A-4	0	95-100	60-100	50-90	30-75	<30	NP-10
Ithaca:											
ItA	0-9	Loam	ML, CL, CL-ML	A-4, A-6	0-3	95-100	95-100	80-100	55-85	18-38	2-15
	9-29	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0-3	95-100	90-100	85-100	60-90	25-55	11-30
	29-60	Clay loam, silty clay loam.	CL	A-6	0-3	95-100	90-100	85-100	60-90	25-36	11-18
Kingsville:											
Ke	0-6	Loamy sand	SM, ML	A-2, A-4	0	100	90-100	80-95	25-55	<38	NP-5
	6-26	Fine sand, loamy sand.	SM	A-2	0	100	90-100	60-80	20-35	---	NP
	26-60	Fine sand	SM, SW-SM	A-2	0	95-100	85-100	70-90	10-25	---	NP
Lamson:											
La	0-26	Loamy very fine sand.	SM, ML	A-4	0	100	100	90-95	40-60	---	NP
	26-35	Fine sandy loam, very fine sand, fine sand.	SM, ML	A-4, A-2	0	95-100	80-100	52-90	25-55	<20	NP-4
	35-60	Stratified fine sand to very fine sand.	SM	A-2, A-4	0	95-100	80-100	60-90	20-50	---	NP
Lenawee:											
Le	0-9	Clay loam	CL	A-6, A-7	0	100	95-100	90-100	70-95	25-45	11-22
	9-37	Silty clay loam, silty clay, clay loam.	CL, CH	A-6, A-7	0	100	95-100	90-100	70-95	25-55	11-30
	37-60	Silt loam, silty clay loam, clay loam.	CL	A-6, A-4, A-7	0	100	95-100	95-100	75-95	25-45	6-22
Marlette:											
MaB, MaC	0-14	Sandy loam	SM, CL, ML, SC	A-4	0-5	95-100	85-95	70-95	40-70	<30	NP-10
	14-34	Clay loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-100	55-90	20-40	5-25
	34-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	15-40	5-25

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Martisco:											
Mc----------------	0-12	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	12-60	Marl------------	---	---	0	---	---	---	---	---	---
Metamora:											
2MeA:											
Metamora part---	0-9	Sandy loam------	SM, SM-SC	A-2, A-4	0-5	95-100	95-100	60-80	25-45	<25	NP-7
	9-37	Sandy loam, sandy clay loam, loam.	SM, SC	A-2, A-4	0-5	95-100	90-100	60-85	30-50	15-30	2-10
	37-60	Clay loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	90-100	80-100	60-85	15-45	5-25
Capac part------	0-8	Sandy loam------	SM, CL, ML, SC	A-4	0-5	95-100	90-100	70-95	40-75	18-30	3-10
	8-28	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	85-100	50-80	25-40	5-20
	28-60	Loam------------	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-75	15-35	5-15
Metea:											
MtB---------------	0-33	Loamy sand------	SM	A-2-4	0	100	100	50-80	15-35	---	NP
	33-39	Clay loam, sandy clay loam, silty clay loam.	CL	A-6, A-7	0	90-100	90-95	75-95	65-75	35-50	15-30
	39-60	Loam, silty clay loam.	CL, ML	A-4, A-6	0-3	85-95	80-90	75-90	50-70	15-30	NP-15
Metea Variant:											
MvB---------------	0-31	Cobbly loamy sand.	SM, SP-SM, GP-GM, GM	A-2-4, A-1, A-2	40-70	50-90	30-80	15-60	5-25	---	NP
	31-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-95	51-75	25-35	5-15
Oakville:											
OaB---------------	0-6	Fine sand-------	SM, SP	A-2, A-3	0	100	100	50-85	0-35	---	NP
	6-60	Fine sand-------	SM, SP	A-2, A-3	0	100	95-100	65-95	0-25	---	NP
Olentangy:											
Oe----------------	0-13	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	13-60	Silt loam, silty clay loam, mucky silt loam	ML, CL	A-4, A-6	0	95-100	95-100	80-100	70-95	20-40	6-15
Palms:											
Pa----------------	0-35	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	35-60	Clay loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
Parkhill:											
Ph----------------	0-9	Loam------------	CL-ML, CL	A-4, A-6	0-5	95-100	90-100	85-95	60-85	20-40	6-18
	9-36	Clay loam, loam, silty clay loam.	CL	A-6	0-5	95-100	90-100	85-100	65-95	25-40	10-20
	36-60	Loam------------	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	80-90	60-75	15-35	5-15
Perrinton:											
PkB, PkC----------	0-8	Loam------------	ML, CL, CL-ML	A-4, A-6	0-5	95-100	95-100	80-100	55-80	18-35	2-15
	8-32	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0-5	95-100	95-100	80-100	65-90	25-55	11-30
	32-60	Clay loam, silty clay loam.	CL	A-6	0-5	95-100	95-100	90-100	65-90	25-36	11-18

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Pert:											
PlA	0-9	Clay loam	CL	A-4, A-6	0	95-100	90-100	85-100	65-90	25-40	9-16
	9-19	Clay, clay loam, silty clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	85-100	70-95	35-70	20-40
	19-60	Silty clay loam, clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	85-100	65-90	35-55	15-35
Pipestone:											
[2]PpA:											
Pipestone part	0-9	Loamy sand	SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	9-44	Sand, loamy sand, fine sand.	SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	44-60	Sand, fine sand	SP-SM, SP	A-3	0	95-100	90-100	50-80	0-10	---	NP
Tedrow part	0-9	Loamy sand	SM	A-2, A-4	0	100	95-100	60-80	20-40	---	NP
	9-45	Loamy fine sand, loamy sand, sand.	SM	A-2, A-4	0	100	95-100	60-80	20-40	---	NP
	45-60	Sand, fine sand	SM, SP	A-2, A-3	0	100	95-100	50-70	3-35	---	NP
[2]PrA:											
Pipestone part	0-9	Loamy sand	SP-SM, SM	A-1, A-2-4, A-3	0	95-100	90-100	40-75	5-30	---	NP
	9-49	Sand	SP, SM	A-1, A-2-4, A-3	0	95-100	90-100	40-75	2-30	---	NP
	49-60	Clay loam, loam, silty clay.	CL, CH, ML	A-4, A-6, A-7	0-5	90-100	90-100	75-100	50-90	25-60	3-34
Tedrow part	0-9	Loamy sand	SM	A-2-4	0	100	95-100	50-90	15-35	---	NP
	9-53	Sand, loamy sand	SM, SP-SM	A-2-4, A-3	0	100	90-100	50-85	5-25	---	NP
	53-60	Silty clay loam	CL, CH, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	90-100	70-90	25-60	6-30
Pits:											
Ps.											
Plainfield:											
PtB, PtC	0-7	Loamy sand	SM	A-2	0	100	100	50-85	15-30	---	NP
	7-60	Sand	SP	A-3	0	100	100	55-65	1-4	---	NP
Riverdale:											
RdA	0-8	Loamy sand	SM, SP-SM	A-1, A-2, A-3	0-5	80-100	65-95	45-70	5-30	<20	NP-4
	8-28	Sand, loamy sand, gravelly sand.	SM, SP-SM	A-1, A-2, A-3	0-5	80-100	65-95	45-70	5-30	<20	NP-4
	28-33	Gravelly sandy loam, sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	85-100	65-90	55-75	15-35	12-35	NP-16
	33-60	Stratified sand to gravel.	SP, GP, SP-SM, GP-GM	A-1	0-10	40-80	35-70	20-45	0-10	---	NP
Saranac:											
Sa	0-23	Silty clay loam	CL	A-6, A-4	0	100	95-100	85-100	70-95	25-40	8-20
	23-37	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	70-90	35-55	20-35
	37-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-90	40-55	20-35

See footnotes 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	
Selfridge:											
SeA	0-32	Loamy sand	SM, SM-SC	A-2	0-5	95-100	95-100	70-85	20-35	<20	NP-5
	32-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-90	25-50	10-25
Sickles:											
Sk	0-9	Loamy sand	SM	A-2-4	0	95-100	90-100	50-75	15-30	---	NP
	9-36	Sand, loamy sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-30	---	NP
	36-60	Clay, silty clay loam, silty clay.	CH, CL	A-7	0	95-100	90-100	90-100	75-95	42-60	29-40
Sloan:											
Sn	0-20	Loam	CL, ML	A-6, A-4, A-7	0	100	95-100	85-100	70-95	30-45	8-15
	20-47	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
	47-60	Stratified sandy loam to silty clay loam.	ML, CL	A-4, A-6	0	95-100	90-100	80-95	65-90	25-40	3-15
Spinks:											
SpB, SpC	0-9	Loamy sand	SM	A-2-4	0	100	80-100	50-90	15-30	---	NP
	9-20	Loamy sand	SM	A-2-4	0	100	80-100	50-90	15-25	---	NP
	20-46	Stratified fine sand to loamy fine sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP
	46-60	Fine sand	SP-SM, SM	A-2-4, A-3	0	100	80-100	50-90	5-25	---	NP
Tedrow:											
TdA	0-9	Loamy sand	SM	A-2, A-4	0	100	95-100	60-80	20-40	---	NP
	9-45	Loamy fine sand, loamy sand, sand.	SM	A-2, A-4	0	100	95-100	60-80	20-40	---	NP
	45-60	Sand, fine sand	SM, SP	A-2, A-3	0	100	95-100	50-70	3-35	---	NP
TeA	0-9	Loamy sand	SM	A-2-4	0	100	95-100	50-90	15-35	---	NP
	9-53	Sand, loamy sand	SM, SP-SM	A-2-4, A-3	0	100	90-100	50-85	5-25	---	NP
	53-60	Silty clay loam	CL, CH, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	90-100	70-90	25-60	6-30
Thomas:											
Th	0-9	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	9-38	Clay loam, loam, silty clay loam.	CL	A-6	0-15	95-100	95-100	85-95	65-95	25-40	8-20
	38-60	Silty clay loam, loam, clay loam.	CL	A-6	0-15	90-95	85-95	80-95	80-95	25-35	12-22
Tobico:											
Tm	0-9	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	9-60	Sand, fine sand	SP, SM	A-1, A-2, A-3	0	75-100	70-100	35-75	0-30	---	NP

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Toledo:											
To----------------	0-9	Clay loam-------	CH, MH, CL	A-7	0	100	100	70-100	70-95	40-65	18-32
	9-48	Silty clay, clay	CH, CL	A-7	0	100	100	95-100	90-100	40-65	18-32
	48-60	Silty clay, clay	CH, CL	A-7	0	100	100	95-100	90-100	40-65	18-36
[2]Ts:											
Toledo part-----	0-9	Clay loam-------	CH, MH, CL	A-7	0	100	100	70-100	70-95	40-65	18-32
	9-48	Silty clay, clay	CH, CL	A-7	0	100	100	95-100	90-100	40-65	18-32
	48-60	Silty clay, clay	CH, CL	A-7	0	100	100	95-100	90-100	40-65	18-36
Sickles part----	0-9	Loamy sand------	SM	A-2-4	0	95-100	90-100	50-75	15-30	---	NP
	9-36	Sand, loamy sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-30	---	NP
	36-60	Clay, silty clay loam, silty clay.	CH, CL	A-7	0	95-100	90-100	90-100	75-95	42-60	29-40
Vestaburg:											
Ve----------------	0-8	Loamy sand------	SM, SP-SM	A-2, A-1	0-5	85-95	75-95	45-75	10-30	---	NP
	8-25	Sand, coarse sand, gravelly loamy sand.	SM, SP-SM	A-2, A-1	0-5	85-95	75-90	40-60	10-20	---	NP
	25-60	Gravelly sand, gravelly loamy sand, coarse sand.	GW, SW, GP, SP	A-1	5-10	50-85	40-75	25-45	0-5	---	NP
Wauseon:											
Wa----------------	0-11	Sandy loam------	SM, ML	A-2, A-4	0	100	95-100	70-85	25-55	<35	NP-8
	11-32	Fine sandy loam, loamy fine sand, very fine sand.	SM	A-2, A-4	0	100	95-100	65-95	20-45	---	NP
	32-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	95-100	90-100	80-95	42-70	20-40
Wixom:											
WxA---------------	0-10	Loamy sand------	SM	A-2-4, A-3	0	95-100	95-100	50-70	15-30	---	NP
	10-38	Loamy sand, sand, loamy sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<20	NP-4
	38-60	Silty clay loam, clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	51-95	20-40	5-25

[1]Nonplastic.
[2]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "erosion factor-(T)" apply to the entire profile. Entries under "Wind erodibility group" 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	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Adrian:										
Ad----------------	0-34	0.2-6.0	0.35-0.45	5.1-7.3	----------	High-----	Moderate	---	---	3
	34-60	6.0-20	0.03-0.08	6.1-8.4	Low-------	High-----	Moderate	---		
Arkona:										
AkA---------------	0-12	2.0-20	0.10-0.12	5.1-7.3	Low-------	Low------	Moderate	0.17	4	2
	12-35	6.0-20	0.06-0.11	5.1-7.3	Low-------	Low------	Moderate	0.17		
	35-60	0.06-0.2	0.08-0.12	6.1-8.4	High------	High-----	Low------	0.28		
Arkport:										
ArB, ArC----------	0-9	2.0-6.0	0.08-0.09	4.5-7.3	Low-------	Low------	Moderate	0.17	3	---
	9-22	2.0-6.0	0.06-0.16	4.5-7.3	Low-------	Low------	Moderate	0.43		
	22-60	2.0-6.0	0.06-0.12	5.1-7.3	Low-------	Low------	Moderate	0.43		
Belleville:										
Be----------------	0-8	6.0-20.0	0.10-0.12	6.1-7.8	Low-------	High-----	Low------	0.17	5	2
	8-35	6.0-20.0	0.06-0.10	6.1-8.4	Low-------	High-----	Low------	0.17		
	35-60	0.2-0.6	0.14-0.20	7.4-8.4	Moderate	High-----	Low------	0.32		
Boyer:										
BoB---------------	0-18	6.0-20	0.10-0.12	5.6-7.3	Low-------	Low------	Moderate	0.17	4	2
	18-24	2.0-6.0	0.12-0.18	5.6-7.8	Low-------	Low------	Moderate	0.24		
	24-60	>20	0.02-0.04	7.4-8.4	Low-------	Low------	Low------	0.10		
Capac:										
CaA---------------	0-8	0.6-2.0	0.16-0.20	5.6-7.3	Low-------	High-----	Low------	0.32	5	5
	8-28	0.2-2.0	0.14-0.18	5.6-7.3	Low-------	High-----	Low------	0.32		
	28-60	0.2-2.0	0.14-0.16	7.4-8.4	Low-------	High-----	Low------	0.32		
Capac Variant:										
[1]CcA:										
Capac Variant part-----------	0-14	0.6-6.0	0.10-0.14	5.6-7.3	Low-------	High-----	Low------	0.32	5	4
	14-25	0.2-2.0	0.05-0.10	5.6-7.3	Moderate	High-----	Low------	0.32		
	25-60	0.2-2.0	0.16-0.19	7.4-8.4	Moderate	High-----	Low------	0.32		
Parkhill part---	0-7	0.6-2.0	0.12-0.15	5.6-7.3	Low-------	High-----	Low------	0.28	5	5
	7-44	0.2-0.6	0.14-0.17	5.6-7.3	Moderate	High-----	Low------	0.28		
	44-60	0.6-2.0	0.15-0.18	7.4-8.4	Moderate	High-----	Low------	0.28		
Ceresco:										
Ce----------------	0-11	2.0-6.0	0.13-0.22	6.1-7.8	Low-------	Low------	Moderate	0.20	5	3
	11-38	0.6-6.0	0.08-0.19	6.1-8.4	Low-------	Low------	Moderate	0.20		
	38-60	>20	0.02-0.04	7.9-8.4	Low-------	Low------	Low------	0.20		
Cohoctah:										
Ch----------------	0-12	2.0-6.0	0.13-0.22	6.1-7.8	Low-------	High-----	Low------	0.28	5	3
	12-37	2.0-6.0	0.12-0.20	6.1-8.4	Low-------	High-----	Low------	0.28		
	37-60	>20	0.02-0.07	7.9-8.4	Low-------	High-----	Low------	0.28		
[1]Co:										
Cohoctah part---	0-12	2.0-6.0	0.13-0.22	6.1-7.8	Low-------	High-----	Low------	0.28	5	3
	12-37	2.0-6.0	0.12-0.20	6.1-8.4	Low-------	High-----	Low------	0.28		
	37-60	>20	0.02-0.07	7.9-8.4	Low-------	High-----	Low------	0.28		
Ceresco part----	0-11	2.0-6.0	0.13-0.22	6.1-7.8	Low-------	Low------	Moderate	0.20	5	3
	11-38	0.6-6.0	0.08-0.19	6.1-8.4	Low-------	Low------	Moderate	0.20		
	38-60	>20	0.02-0.04	7.9-8.4	Low-------	Low------	Low------	---		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Corunna:										
Cr----------------	0-9	0.6-6.0	0.14-0.22	6.1-7.8	Low--------	High-----	Low------	0.20	4	3
	9-31	0.6-6.0	0.08-0.14	6.1-7.8	Low--------	High-----	Low------	0.20		
	31-60	0.2-0.6	0.16-0.20	7.4-8.4	Moderate	High-----	Low------	0.43		
Dixboro:										
DxA---------------	0-15	2.0-6.0	0.16-0.22	5.6-7.3	Low--------	Moderate	Moderate	0.20	5	3
	15-38	0.6-6.0	0.10-0.20	5.6-7.8	Low--------	Moderate	Moderate	0.20		
	38-60	0.6-6.0	0.07-0.20	7.4-8.4	Low--------	Moderate	Low------	0.20		
Edwards:										
Ed----------------	0-35	0.2-6.0	0.35-0.45	5.6-7.8	----------	High-----	Low------	---	---	3
	35-60	---	---	7.4-8.4	----------	High-----	Low------	---		
Gilford:										
Gd----------------	0-11	2.0-6.0	0.16-0.18	6.1-6.5	Low--------	High-----	Moderate	0.20	5	3
	11-29	2.0-6.0	0.10-0.14	6.1-7.3	Low--------	High-----	Moderate	0.20		
	29-40	6.0-20	0.05-0.08	6.6-8.4	Low--------	High-----	Low------	0.20		
	40-60	>20	0.02-0.04	6.6-8.4	Low--------	High-----	Low------	0.10		
Houghton:										
Ho----------------	0-60	0.2-6.0	0.35-0.45	6.1-7.3	----------	High-----	Low------	---	---	3
Huntington:										
HuB---------------	0-11	0.6-2.0	0.18-0.24	5.6-7.8	Low--------	Low------	Moderate	0.32	5	---
	11-55	0.6-2.0	0.10-0.16	5.6-7.8	Low--------	Low------	Moderate	0.32		
	55-60	0.6-2.0	0.10-0.16	5.6-7.8	Low--------	Low------	Moderate	0.32		
Ithaca:										
ItA---------------	0-9	0.6-2.0	0.20-0.24	5.1-7.3	Low--------	High-----	Moderate	0.32	5	6
	9-29	0.2-0.6	0.10-0.20	5.1-7.8	Moderate	High-----	Low------	0.32		
	29-60	0.2-0.6	0.13-0.20	7.9-8.4	Moderate	High-----	Low------	0.32		
Kingsville:										
Ke----------------	0-6	2.0-6.0	0.07-0.15	6.1-7.3	Low--------	High-----	High-----	0.24	3	---
	6-26	6.0-20	0.07-0.12	6.1-7.3	Low--------	High-----	High-----	0.17		
	26-60	6.0-20	0.07-0.10	6.6-7.8	Low--------	High-----	Moderate	0.17		
Lamson:										
La----------------	0-26	2.0-6.0	0.11-0.13	6.1-8.4	Low--------	High-----	Low------	0.32	3	---
	26-35	2.0-6.0	0.02-0.04	6.1-8.4	Low--------	High-----	Low------	0.43		
	35-60	2.0-6.0	0.09-0.13	7.4-8.4	----------	---------	---------	0.43		
Lenawee:										
Le----------------	0-9	0.6-2.0	0.17-0.22	5.6-6.0	Moderate	High-----	Low------	0.28	4	7
	9-37	0.2-0.6	0.18-0.20	6.6-7.8	Moderate	High-----	Low------	0.28		
	37-60	0.6-2.0	0.18-0.22	7.4-7.8	Low--------	High-----	Low------	0.28		
Marlette:										
MaB, MaC----------	0-14	2.0-6.0	0.12-0.22	5.6-7.3	Low--------	Low------	Moderate	0.32	5	5
	14-34	0.2-2.0	0.18-0.20	5.6-7.8	Low--------	Low------	Moderate	0.32		
	34-60	0.2-2.0	0.12-0.19	7.9-8.4	Low--------	Low------	Low------	0.32		
Martisco:										
Mc----------------	0-12	0.2-6.0	0.25-0.35	6.1-8.4	Low--------	High-----	Low------	---	---	---
	12-60	0.06-0.2	---	7.9-8.4	Low--------	High-----	Low------	---		
Metamora:										
[1]MeA:										
Metamora part---	0-9	2.0-6.0	0.14-0.18	5.1-7.3	Low--------	Moderate	Moderate	0.20	5	3
	9-37	2.0-6.0	0.16-0.18	5.1-7.3	Low--------	Moderate	Moderate	0.32		
	37-60	0.2-0.6	0.14-0.18	6.6-8.4	Moderate	High-----	Low------	0.32		
Capac part------	0-8	0.6-2.0	0.16-0.20	5.6-7.3	Low--------	High-----	Low------	0.32	5	5
	8-28	0.2-2.0	0.14-0.18	5.6-7.3	Low--------	High-----	Low------	0.32		
	28-60	0.2-2.0	0.14-0.16	7.4-8.4	Low--------	High-----	Low------	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodi-bility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Metea:										
MtB----------------	0-33	>20	0.10-0.12	5.6-7.3	Low--------	Low-------	Moderate	0.17	5	2
	33-39	0.6-2.0	0.15-0.19	5.6-7.3	Moderate	Moderate	Moderate	0.32		
	39-60	0.2-2.0	0.05-0.19	7.4-8.4	Low--------	Low-------	Low-------	0.32		
Metea Variant:										
MvB----------------	0-31	6.0-20	0.02-0.06	6.1-7.3	Low--------	Low-------	Moderate	0.17	3	2
	31-60	0.2-2.0	0.12-0.19	7.4-8.4	Moderate	Low-------	Low-------	0.32		
Oakville:										
OaB----------------	0-6	>20.0	0.07-0.09	5.6-7.3	Low--------	Low-------	Moderate	0.15	5	1
	6-60	>20.0	0.06-0.08	5.6-7.3	Low--------	Low-------	Moderate	0.15		
Olentangy:										
Oe-----------------	0-38	0.2-6.0	0.24-0.34	<4.5	-----------	High------	High------	---	---	8
	38-60	0.06-0.2	0.18-0.24	7.4-8.4	Low--------	High------	Low-------	---		
Palms:										
Pa-----------------	0-35	0.2-6.0	0.35-0.45	5.1-8.4	-----------	High------	Moderate	---	---	3
	35-60	0.2-2.0	0.05-0.19	6.1-8.4	Low--------	High------	Low-------	---		
Parkhill:										
Ph-----------------	0-9	0.6-2.0	0.20-0.22	6.1-7.3	Low--------	High------	Low-------	0.28	5	5
	9-36	0.2-0.6	0.15-0.19	6.1-7.8	Low--------	High------	Low-------	0.28		
	36-60	0.6-2.0	0.17-0.19	7.4-8.4	Low--------	High------	Low-------	0.28		
Perrinton:										
PkB, PxC-----------	0-8	0.6-2.0	0.20-0.24	5.6-6.5	Low--------	High------	Moderate	0.32	4	6
	8-32	0.2-0.6	0.10-0.20	5.6-7.3	Moderate	High------	Moderate	0.32		
	32-60	0.2-0.6	0.14-0.20	7.9-8.4	Moderate	High------	Low-------	0.32		
Pert:										
PlA----------------	0-9	0.2-2.0	0.17-0.22	6.1-7.3	High-------	High------	Low-------	0.37	3	6
	9-19	0.06-0.6	0.08-0.20	6.6-7.3	High-------	High------	Low-------	0.37		
	19-60	0.06-0.6	0.07-0.14	7.4-8.4	High-------	High------	Low-------	0.37		
Pipestone:										
[1]PpA:										
Pipestone part--	0-9	6.0-20	0.07-0.10	4.5-7.3	Low--------	Low-------	Moderate	0.17	5	1
	9-44	6.0-20	0.06-0.09	4.5-7.3	Low--------	Low-------	Moderate	0.17		
	44-60	>20	0.05-0.07	5.1-7.3	Low--------	Low-------	Moderate	0.17		
Tedrow part-----	0-9	6.0-20	0.08-0.12	6.1-7.3	Low--------	Low-------	Low-------	0.17	5	2
	9-45	6.0-20	0.07-0.11	6.1-7.3	Low--------	Low-------	Low-------	0.17		
	45-60	6.0-20	0.05-0.07	6.6-7.8	Low--------	Low-------	Low-------	0.17		
[1]PrA:										
Pipestone part--	0-9	6.0-20	0.06-0.10	4.5-7.3	Low--------	Low-------	Moderate	0.17	5	1
	9-49	6.0-20	0.04-0.08	4.5-7.3	Low--------	Low-------	Moderate	0.17		
	49-60	0.2-0.6	0.16-0.18	7.4-8.4	Moderate	High------	Low-------	0.32		
Tedrow part-----	0-9	6.0-20	0.09-0.12	5.1-7.3	Low--------	Low-------	Moderate	0.17	5	2
	9-53	6.0-20	0.06-0.11	5.6-7.8	Low--------	Low-------	Moderate	0.17		
	53-60	0.2-0.6	0.14-0.22	7.4-8.4	Moderate	High------	Low-------	0.17		
Pits:										
Ps.										
Plainfield:										
PtB, PtC-----------	0-7	6.0-20	0.10-0.12	4.5-6.5	Low--------	Low-------	Moderate	0.17	5	2
	7-60	6.0-20	0.06-0.08	4.5-6.5	Low--------	Low-------	Moderate	0.17		
Riverdale:										
RdA----------------	0-8	6.0-20	0.06-0.12	6.1-7.8	Low--------	Low-------	Low-------	0.17	4	1
	8-28	6.0-20	0.05-0.11	6.1-7.8	Low--------	Low-------	Low-------	0.17		
	28-33	2.0-6.0	0.05-0.13	6.1-7.8	Low--------	Low-------	Low-------	0.17		
	33-60	>20	0.02-0.04	7.9-8.4	Low--------	Low-------	Low-------	0.10		
Saranac:										
Sa-----------------	0-23	0.2-0.6	0.17-0.22	6.1-7.8	Moderate	High------	Low-------	0.24	5	6
	23-37	0.2-0.6	0.10-0.20	6.1-7.8	Moderate	High------	Low-------	0.24		
	37-60	0.2-0.6	0.10-0.20	6.6-8.4	Moderate	High------	Low-------	0.24		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Selfridge:										
SeA	0-32	6.0-20	0.10-0.12	5.6-7.3	Low	Low	Moderate	0.15	5	2
	32-60	0.2-2.0	0.14-0.20	7.4-8.4	Moderate	High	Low	0.37		
Sickles:										
Sk	0-9	2.0-6.0	0.10-0.12	5.6-6.5	Low	High	Moderate	0.17	4	2
	9-36	6.0-20	0.06-0.11	6.1-7.3	Low	High	Low	0.17		
	36-60	0.06-0.2	0.08-0.12	7.9-8.4	High	High	Low	0.32		
Sloan:										
Sn	0-20	0.6-2.0	0.20-0.24	6.1-7.8	Moderate	High	Low	0.37	5	---
	20-47	0.2-2.0	0.15-0.19	6.1-8.4	Moderate	High	Low	0.37		
	47-60	0.2-2.0	0.13-0.18	6.6-8.4	Low	High	Low	0.37		
Spinks:										
SpB, SpC	0-9	6.0-20	0.08-0.10	5.6-7.3	Low	Low	Low	0.17	5	2
	9-20	6.0-20	0.08-0.10	5.6-7.3	Low	Low	Low	0.17		
	20-46	2.0-20	0.04-0.08	5.6-7.8	Low	Low	Low	0.17		
	46-60	6.0-20	0.04-0.06	6.6-8.4	Low	Low	Low	0.17		
Tedrow:										
TdA	0-9	6.0-20	0.08-0.12	6.1-7.3	Low	Low	Low	0.17	5	2
	9-45	6.0-20	0.07-0.11	6.1-7.3	Low	Low	Low	0.17		
	45-60	6.0-20	0.05-0.07	6.6-7.8	Low	Low	Low	0.17		
TeA	0-9	6.0-20	0.09-0.12	5.1-7.3	Low	Low	Moderate	0.17	5	2
	9-53	6.0-20	0.06-0.11	5.6-7.8	Low	Low	Moderate	0.17		
	53-60	0.2-0.6	0.14-0.22	7.4-8.4	Moderate	High	Low	0.32		
Thomas:										
Th	0-9	0.2-6.0	0.35-0.45	6.6-7.8	----------	High	Low	---	---	3
	9-38	0.6-2.0	0.12-0.20	7.4-8.4	Moderate	High	Low	---		
	38-60	0.06-0.6	0.12-0.18	7.4-8.4	Moderate	High	Low	---		
Tobico:										
Tm	0-9	0.2-6.0	0.35-0.45	6.6-7.8	Low	High	Low	0.15	4	---
	9-60	>20	0.04-0.07	7.4-8.4	Low	High	Low	0.15		
Toledo:										
To	0-9	0.6-2.0	0.16-0.22	6.1-7.3	High	High	Low	0.28	5	7
	9-48	0.06-0.2	0.12-0.16	6.1-7.8	High	High	Low	0.28		
	48-60	0.06-0.2	0.08-0.12	7.4-8.4	High	High	Low	0.28		
[1]Ts:										
Toledo part	0-9	0.6-2.0	0.16-0.22	6.1-7.3	High	High	Low	0.28	5	7
	9-48	0.06-0.2	0.12-0.16	6.1-7.8	High	High	Low	0.28		
	48-60	0.06-0.2	0.08-0.12	7.4-8.4	High	High	Low	0.28		
Sickles part	0-9	2.0-6.0	0.10-0.12	5.6-6.5	Very	High	Moderate	0.17	4	2
	9-36	6.0-20	0.06-0.11	6.1-7.3	Very	High	Low	0.17		
	36-60	0.06-0.2	0.08-0.12	7.9-8.4	High	High	Low	0.32		
Vestaburg:										
Ve	0-8	2.0-6.0	0.10-0.12	6.6-7.8	Low	High	Low	0.17	4	2
	8-25	6.0-20	0.06-0.08	6.6-7.8	Low	High	Low	0.17		
	25-60	>20	0.02-0.04	7.4-8.4	Low	High	Low	0.10		
Wauseon:										
Wa	0-11	2.0-6.0	0.12-0.18	6.1-7.3	Low	High	Low	0.20	5	3
	11-32	6.0-20.0	0.06-0.10	6.6-7.8	Low	High	Low	0.20		
	32-60	<0.06	0.06-0.10	7.4-7.8	High	High	Low	0.20		
Wixom:										
WxA	0-10	6.0-20	0.10-0.12	5.1-6.5	Low	Low	Moderate	0.15	4	2
	10-38	6.0-20	0.06-0.11	5.1-6.5	Low	Low	Moderate	0.15		
	38-60	0.2-0.6	0.14-0.20	6.1-7.8	Moderate	High	Low	0.43		

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 17.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern.]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	
					Ft			
Adrian:								
Ad	A/D	Frequent	Long	Nov-May	0-1.0	Apparent	Nov-May	High.
Arkona:								
AkA	C	Rare	---	---	0.5-1.5	Apparent	Nov-May	Moderate.
Arkport:								
ArB, ArC	B	None	---	---	>6.0	---	---	Low.
Belleville:								
Be	B/D	Frequent	Brief	Mar-Apr	0-1.0	Apparent	Mar-May	High.
Boyer:								
BoB	B	None	---	---	>6.0	---	---	Low.
Capac:								
CaA	B	Rare	---	---	1.0-2.0	Apparent	Nov-May	High.
Capac Variant:								
[1]CcA:								
Capac Variant part	B	Rare	---	---	1.0-2.0	Apparent	Nov-May	High.
Parkhill part	D	Frequent	Long	Oct-Jun	0-1.5	Apparent	Sep-Jul	High.
Ceresco:								
Ce	B	Frequent	Long	Mar-May	1.0-2.0	Apparent	Sep-May	High.
Cohoctah:								
Ch	D	Frequent	Long	Jan-Dec	0-1.0	Apparent	Sep-May	High.
[1]Co:								
Cohoctah part	D	Frequent	Long	Jan-Dec	0-1.0	Apparent	Sep-May	High.
Ceresco part	B	Frequent	Long	Mar-May	1.0-2.0	Apparent	Sep-May	High.
Corunna:								
Cr	B/D	Frequent	Brief	Mar-May	0-1.0	Apparent	Nov-May	High.
Dixboro:								
DxA	B	Rare	---	---	1.0-2.0	Apparent	Nov-Apr	High.
Edwards:								
Ed	B/D	Frequent	Long	Sep-May	0-0.5	Apparent	Sep-Jun	High.
Gilford:								
Gd	B	Frequent	Brief	Dec-May	0-1.0	Apparent	Dec-May	High.
Houghton:								
Ho	A/D	Frequent	Long	Nov-May	0-1.0	Apparent	Sep-Jun	High.
Huntington:								
HuB	B	None	---	---	3.0-6.0	Apparent	Dec-Apr	High.
Ithaca:								
ItA	C	Rare	---	---	1.0-2.0	Perched	Oct-May	High.
Kingsville:								
Ke	C	Frequent	Long	Nov-May	0-1.0	Apparent	Jan-Apr	Moderate.
Lamson:								
La	D	Frequent	Brief	Jan-May	0-0.5	Apparent	Dec-May	High.

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
		Frequency	Duration	Months	Depth	Kind	Months	
					Ft			
Lenawee:								
Le	B/D	Frequent	Brief	Mar-May	0-1.0	Apparent	Nov-May	High.
Marlette:								
MaB, MaC	B	None	---	---	>6.0	---	---	Moderate.
Martisco:								
Mc	D	Frequent	Long to very long.	Oct-Jun	0-0.5	Apparent	Oct-Jun	High.
Metamora:								
[1]MeA:								
Metamora part	B	Rare	---	---	1.0-3.0	Apparent	Nov-May	High.
Capac part	B	Rare	---	---	1.0-2.0	Apparent	Nov-May	High.
Metea:								
MtB	A	None	---	---	>6.0	---	---	Moderate.
Metea Variant:								
MvB	B	None	---	---	>6.0	---	---	Low.
Oakville:								
OaB	A	None	---	---	>6.0	---	---	Low.
Olentangy:								
Oe	A/D	Frequent	Brief	Oct-Jul	0-1.0	Apparent	Oct-Jul	High.
Palms:								
Pa	A/D	Frequent	Long	Nov-May	0-1.0	Apparent	Nov-May	High.
Parkhill:								
Ph	B/D	Frequent	Brief	Mar-Apr	0-1.5	Apparent	Nov-May	High.
Perrinton:								
PkB, PkC	C	None	---	---	2.5-5.0	Perched	Nov-Apr	Moderate.
Pert:								
PlA	D	Rare	---	---	1.0-2.0	Apparent	Nov-May	High.
Pipestone:								
[1]PpA:								
Pipestone part	A	None	---	---	0.5-1.5	Apparent	Oct-Jun	Moderate.
Tedrow part	B	None	---	---	0.5-1.5	Apparent	Jan-Apr	Moderate.
[1]PrA:								
Pipestone part	C	None	---	---	0.5-1.5	Apparent	Nov-May	Moderate.
Tedrow part	B	None	---	---	0.5-1.5	Apparent	Nov-May	Moderate.
Pits:								
Ps.								
Plainfield:								
PtB, PtC	A	None	---	---	>6.0	---	---	Low.
Riverdale:								
RdA	A	None	---	---	1.0-2.0	Apparent	Nov-May	Moderate.
Saranac:								
Sa	D	Frequent	Very long	Jan-Dec	0-1.0	Apparent	Sep-Jun	High.
Selfridge:								
SeA	C	Rare	---	---	1.5-2.0	Apparent	Nov-May	High.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	
					Ft			
Sickles:								
Sk	D	None	---	---	0-1.0	Apparent	Dec-May	Moderate.
Sloan:								
Sn	B/D	Frequent	Very brief	Nov-Jun	0-0.5	Apparent	Nov-Jun	High.
Spinks:								
SpB, SpC	A	None	---	---	>6.0	---	---	Low.
Tedrow:								
TdA	B	None	---	---	0.5-1.5	Apparent	Jan-Apr	Moderate.
TeA	B	None	---	---	1.0-2.5	Apparent	Nov-May	Moderate.
Thomas:								
Th	D	Occasional	Brief	Jan-Apr	0-0.5	Apparent	Nov-Jun	High.
Tobico:								
Tm	D	Frequent	Brief	Sep-May	0-1.0	Apparent	Sep-Jun	Moderate.
Toledo:								
To	D	None	---	---	0-0.5	Perched	Dec-May	Moderate.
[1]Ts:								
Toledo part	D	None	---	---	0-0.5	Perched	Dec-May	Moderate.
Sickles part	D	None	Long	Nov-May	0-1.0	Apparent	Dec-May	Moderate.
Vestaburg:								
Ve	D	Frequent	Long	Nov-Apr	0-1.0	Apparent	Oct-May	Moderate.
Wauseon:								
Wa	B/D	None	---	---	0-0.5	Perched	Jan-Apr	Moderate.
Wixom:								
WxA	B	Rare	---	---	1.0-2.0	Perched	Nov-Jun	Moderate.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Aquents	Aquents
Arkona	Sandy over clayey, mixed, mesic Alfic Haplaquods
*Arkport	Coarse-loamy, mixed, mesic Psammentic Hapludalfs
*Belleville	Sandy over loamy, mixed, mesic Typic Haplaquolls
Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
Capac	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Capac Variant	Loamy-skeletal, mixed, mesic Aeric Ochraqualfs
Ceresco	Coarse-loamy, mixed, mesic Fluvaquentic Hapludolls
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
*Corunna	Coarse-loamy, mixed, mesic Typic Haplaquolls
Dixboro	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Edwards	Marly, euic, mesic Limnic Medisaprists
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Houghton	Euic, mesic Typic Medisaprists
Huntington	Fine-silty, mixed, mesic Fluventic Hapludolls
Ithaca	Fine, mixed, mesic Glossaquic Hapludalfs
*Kingsville	Mixed, mesic Mollic Psammaquents
Lamson	Coarse-loamy, mixed, nonacid, mesic Aeric Haplaquepts
Lenawee	Fine, mixed, nonacid, mesic Mollic Haplaquepts
Marlette	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Martisco	Fine-silty, carbonatic, mesic Histic Humaquepts
Metamora	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Metea	Loamy, mixed, mesic Arenic Hapludalfs
Metea Variant	Loamy, mixed, mesic Arenic Hapludalfs
Oakville	Mixed, mesic Typic Udipsamments
Olentangy	Loamy, coprogenous, euic, mesic Terric Medilimnists
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Parkhill	Fine-loamy, mixed, nonacid, mesic Mollic Haplaquepts
Perrinton	Fine, mixed, mesic Glossoboric Hapludalfs
Pert	Fine, illitic, mesic Aquic Hapludalfs
Pipestone	Sandy, mixed, mesic Entic Haplaquods
Plainfield	Mixed, mesic Typic Udipsamments
Riverdale	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Saranac	Fine, mixed, mesic Fluvaquentic Haplaquolls
Selfridge	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Sickles	Sandy over clayey, mixed, nonacid, mesic Mollic Haplaquents
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs
Tedrow	Mixed, mesic Aquic Udipsamments
Thomas	Fine-loamy, mixed (calcareous), mesic Histic Humaquepts
Tobico	Mixed, mesic Mollic Psammaquents
Toledo	Fine, illitic, nonacid, mesic Mollic Haplaquepts
Udorthents	Udorthents
Vestaburg	Mixed, mesic Mollic Psammaquents
Wauseon	Coarse-loamy over clayey, mixed, mesic Typic Haplaquolls
Wixom	Sandy over loamy, mixed, mesic Alfic Haplaquods

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