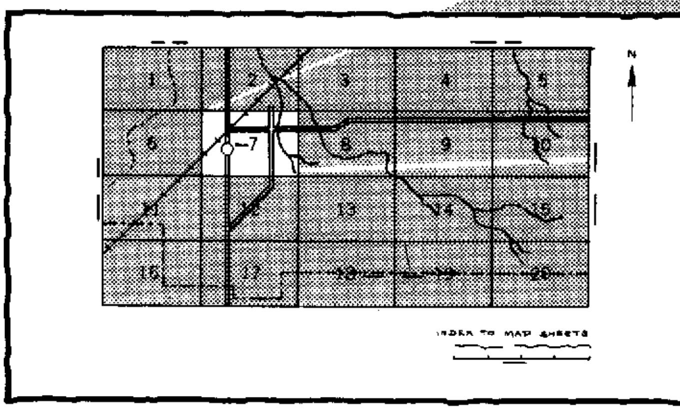
SOIL SURVEY OF

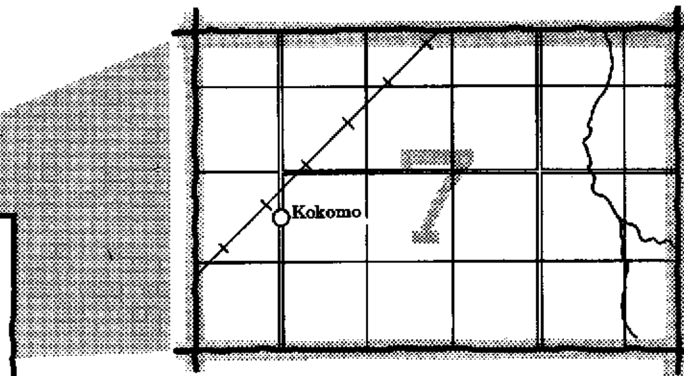
La Porte County, Indiana

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Purdue University Agricultural Experiment Station
and the
Indiana Department of Natural Resources, Soil and Water Conservation Committee

HOW TO USE

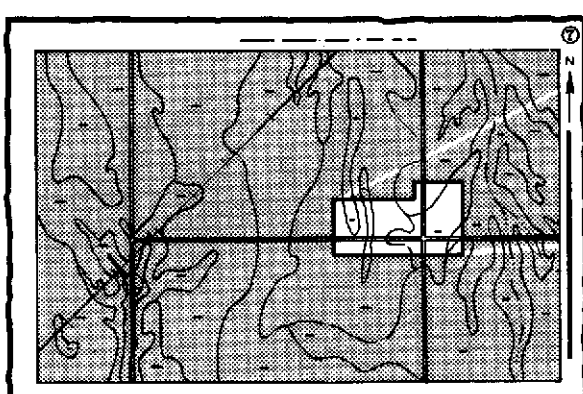
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

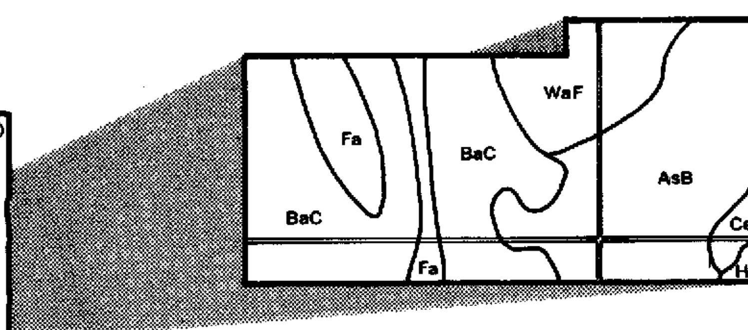




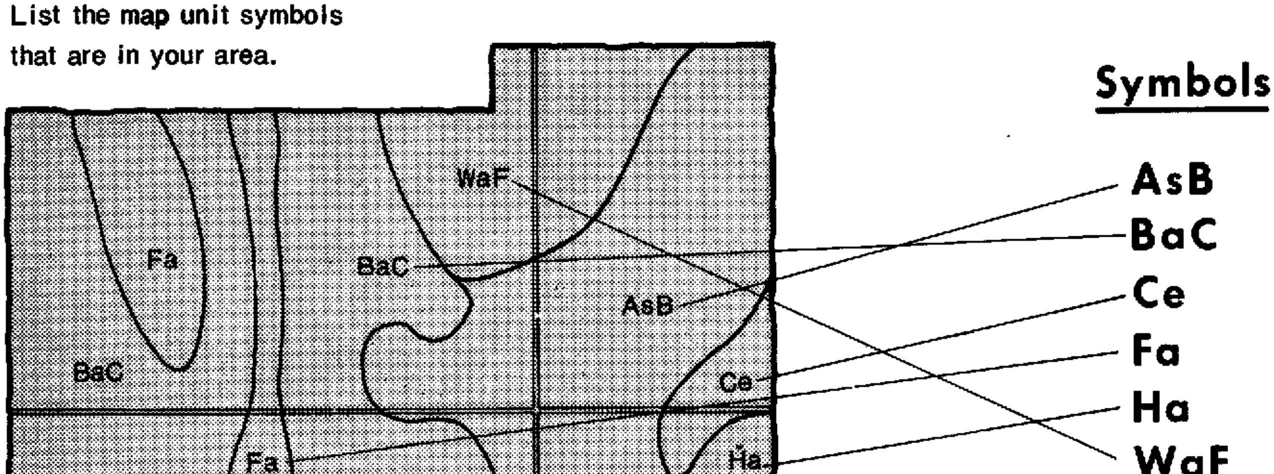
2. Note the number of the map sheet and turn to that sheet.

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



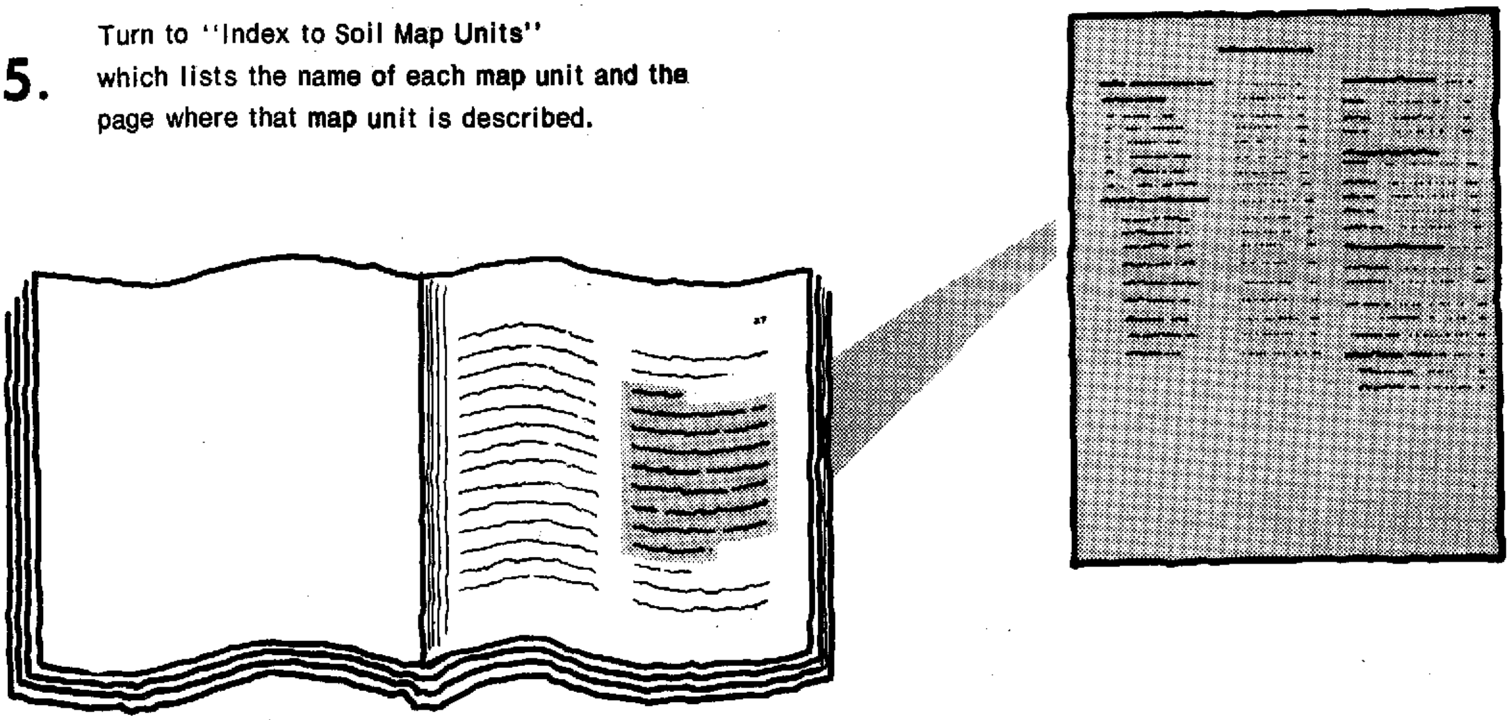


4. List the map unit symbols that are in your area.

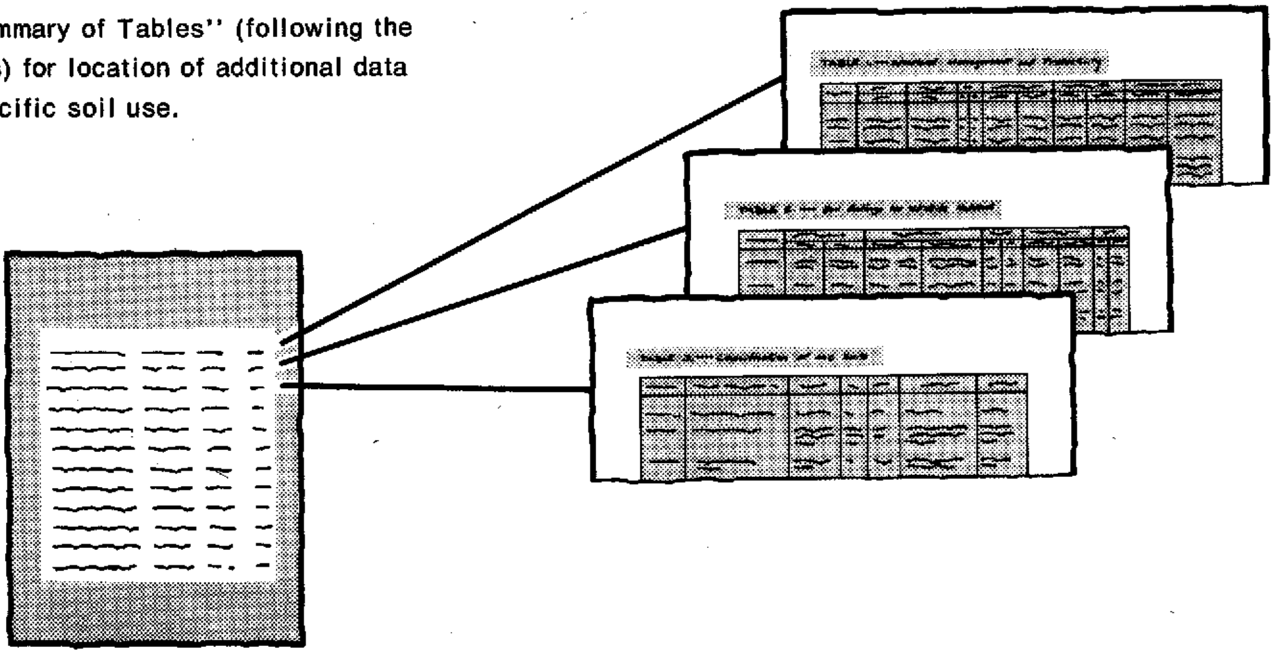


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was performed in the period 1971 to 1977. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service, Purdue University Agricultural Experiment Station, and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the La Porte County Soil and Water Conservation District. Financial assistance was made available by the Board of County Commissioners of La Porte County.

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

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soil series

Issued January 1982

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foreword

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

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

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

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

Robert L. Eddleman

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State Conservationist
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soil survey of
La Porte County, Indiana

By G. Franklin Furr, Jr., Soil Conservation Service

Fieldwork by G. Franklin Furr, Jr., Benjamin F. Smallwood, Robert H. Montgomery, Jerry A. Thomas, and Rex A. Brock, Soil Conservation Service and Larry P. Huber, Soil and Water Conservation Committee, Indiana Department of Natural Resources

United States Department of Agriculture, Soil Conservation Service
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La Porte County, in the northwestern part of Indiana, has Lake Michigan and the state of Michigan on its northern border (fig. 1). It has a total area of 608 square miles, or 389,120 acres. La Porte, the county seat, is in the central part of the county. The population of La Porte County is about 105,342.

The first soil survey of La Porte County was published in 1944 (*4*). This survey updates the first survey and provides additional information and larger maps that show soils in greater detail.

The Valparaiso Moraine extends across the county in a northeastern direction and divides drainage into northern and southern areas. The land south of the moraine is made up of nearly level to gently sloping soils and drains south into the Kankakee River. The moraine is made up of gently sloping to steep soils that are well dissected by small drainageways. The land north of the moraine is made up of nearly level to steep soils that are lacustrine or sandy. It drains north into Lake Michigan. Elevation of the land ranges from 581 feet on the shore of Lake Michigan to about 957 feet above sea level.

About 67 percent of the county is actively farmed. Urban development is continually decreasing the acreage of farms. Most soils of the county are used for truck farms. Corn, soybeans, and wheat are the principal crops. The morainic soils and a few areas bordering the moraine are used for orchards. Some of the sandy soils within the moraine are used for the vineyards of a new winery. Urban development is active along the moraine at this time; however the moraine is used primarily for small farms and woodland. Farming is difficult in the moraine because of slopes and the soil conditions.

general nature of the survey area

The first settlers moved into the county about 1829 and settled near the present town of Westville. Indians had occupied the region, but all moved west of the Mississippi River by 1838. The county was organized on January 9, 1832. It was named for an opening in a forest that was near Door Village, which was called La Porte, meaning 'the door' in French. La Porte had three townships. These were later subdivided to make additional townships. The towns of Cass, Dewey, and Hanna, originally part of Starke County, were added to La Porte County by an act of the state legislature in 1842. The towns of Lincoln and Johnson were added in 1850.

The moraine and the outwash prairie were the first areas settled. The Kankakee Marsh was not settled until the river was dredged. The settlers came from Ohio, New York, Pennsylvania, and other eastern states (*4*).

La Porte, the county seat, was laid out in 1833. In 1850 the population was 1,824, and in 1970 it was 22,140. La Porte County had a population of 12,169 in 1850; 63,660 in 1940; and 105,342 in 1970.

General features that have an effect on use of the soils in La Porte County are briefly discussed.

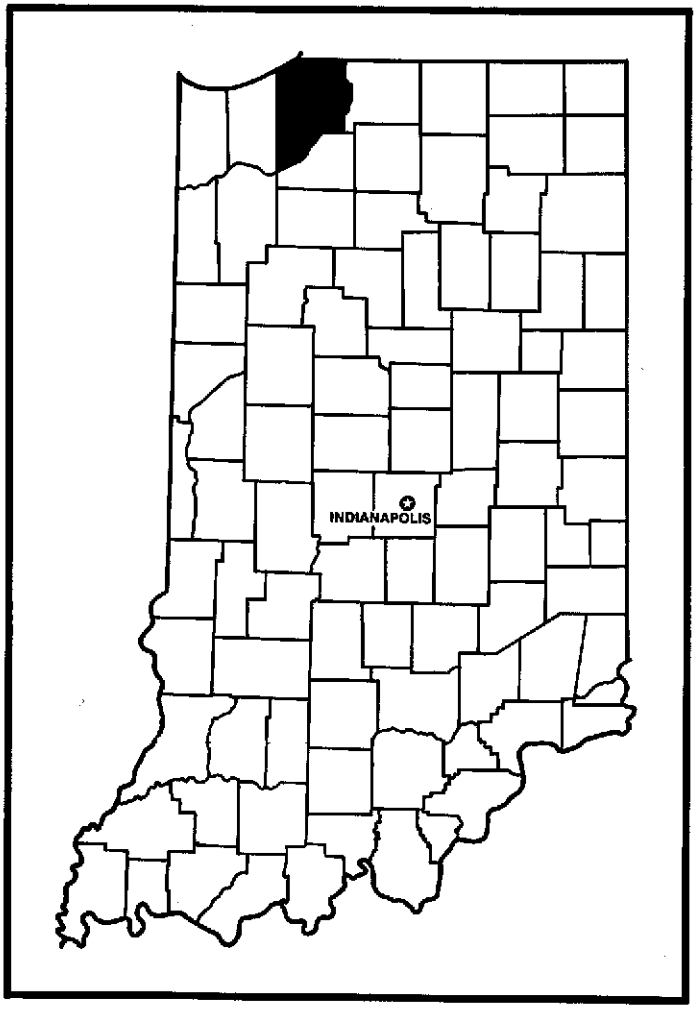

Figure 1.—Location of La Porte County, Indiana.

relief and drainage

The highest point in La Porte County is 957 feet above sea level. It is located on a knoll east of Lambs Chapel in Galena Township, about 6.5 miles north of the city of La Porte. The lowest point in the county is 581 feet above sea level. It is located on the shore of Lake Michigan. The average elevation of the county is 730 feet above sea level. This is 149 feet above the level of Lake Michigan.

The relief of La Porte County ranges from nearly level or depressional to steep. In the southern part of the county, the Kankakee Valley is mainly nearly level or depressional to gently sloping. This area has an average elevation of about 670 feet above sea level. It was a swamp until the river was dredged. It is drained by an extensive system of drainage ditches, which have made most of the land tillable. The outwash plain is north of the Kankakee Valley and is nearly level to strongly sloping. Some streams transect the outwash plain and flow into the Kankakee Valley. In the center of the county the prairie outwash plain is mainly nearly level to strongly sloping and is pitted. Some of the pitted areas hold water for long periods of time, and some hold water for only a few days after periods of heavy rainfall.

The moraine area in the northern part of the county consists of two basic areas. One is the Valparaiso Moraine, which is a dissected ridge. The highest point in the county is on this ridge. The ridge is mainly gently sloping to moderately steep and has many streams that begin near lakes or muck beds. The local relief of this area ranges from 100 to 150 feet. The relief is lowest where streams have cut down through the range to the level of Lake Michigan. The Valparaiso Moraine is the dividing point between water flowing to the Gulf of Mexico and water flowing to the Atlantic Ocean. The other part of the moraine is the Lake Border Morainic System, which parallels Lake Michigan. This morainic system consists of several low, rounded ridges of ground moraine deposits and a few, abrupt changes in relief. The sand plain borders Lake Michigan and consists of numerous sand dune ridges and swells and some low, wet flats. This area has a belt of high dunes which rise from 80 to 150 feet above the level of the lake and which form an almost continuous band around Lake Michigan.

water supply

Ground water is the main source of water in La Porte County. Adequate supplies are available for drinking, household uses, and farmstead uses in most areas of the county. Supplies are generally adequate for industrial uses also. Wells are fairly shallow in all areas except in the moraine. The wells in the moraine are deeper and are not always reliable for a bountiful water supply, even for household purposes. Artesian wells and springs are fairly common on the north side of the moraine.

Lake Michigan is used as a source of water by Michigan City, the incorporated villages along the lake shore, and the industries in the city.

Irrigation water is drawn from some ditches in the county and from wells in the outwash plains.

climate

La Porte County is cold and snowy in winter and warm in summer. Areas nearest the lake are markedly cooler in summer than the rest of the county. Precipitation is well distributed during the year and is adequate for most crops on most soils. From late fall through winter, snow squalls are frequent, and total snowfall is normally heavy. In some years a single, prolonged storm can produce more than 2 feet of snow on the ground, and strong winds create deep drifts.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at La Porte, Indiana, for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter the average temperature is 27 degrees F, and the average daily minimum temperature is 19 degrees. The lowest temperature on record, which occurred at La Porte on February 2, 1951, is -23 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred on September 1, 1953, is 104 degrees.

Growing degree days, shown in Table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 25 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall during the period of record was 5.52 inches at La Porte on October 10, 1954. Thunderstorms occur on about 45 days each year, and most occur in summer.

Average seasonal snowfall is 72 inches. The greatest depth of snow at any one time during the period of record was 38 inches. On the average 21 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 65 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 70 in summer and 35 in winter. The prevailing wind is from the south-southwest. Average wind speed is highest, 12 miles per hour, in March.

Crop growth is slowed early in the growing season by frequent cool winds off of a cold lake. This slowing is important to fruit crops, which usually do not blossom until spring freezes are past. Fall winds, which are warm because they blow off of a relatively warm lake, delay the first fall freeze and prolong the growing season for all crops.

Climatic data for this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

transportation facilities

There are 237 miles of highways in La Porte County. This includes 11 miles of interstate, 25 miles of the Indiana Toll Road, 116 miles of U.S. Highway and 85 miles of state highways. There is approximately 1,200 miles of county roads in La Porte County, and most of these roads are paved. The major highways criss-cross the county so that all parts of the county are accessible.

Three airports serve small private planes and a small commuter airline in La Porte County.

Eight main railroad lines cross the county and serve it with approximately 320 miles of track. A commuter line offers the only passenger service from La Porte County.

manufacturing and business services of agriculture

La Porte, the county seat of La Porte County, has many different industries. Most of these are fairly small industries. One farm machinery manufacturing plant and some plants that produce food products are located in La Porte. Michigan City, the largest city in La Porte County, has many industries that are also fairly small. These industries employ part of the labor force of the county.

Grain is marketed through local elevators and major grain terminals on the shore of Lake Michigan, near Chicago.

Milk from the numerous dairy farms is shipped out of the county for processing.

Chicago is the major livestock market for cattle and some hogs; however, Logansport is the major market for hogs.

trends in population and land use

La Porte County has a population of about 105,342 people and a population density of about 175 people per square mile. Population increased 10.8 percent between 1960 and 1970.

During the period 1958 to 1967, urbanized land increased by about 10 percent, and all categories of agricultural land decreased by the same amount. In 1974, 67 percent of the county remained in agricultural use. Approximately 500 acres of land is being converted to urban uses each year. This trend is expected to continue at the same rate for several years.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. 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; and the kinds of rock. They dug many holes to study 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 plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management 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 can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map 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 can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

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

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *intensive cultivated crops, specialty crops, woodland, urban uses,* and *intensive recreation areas*. Cultivated crops are those grown extensively in the survey area. Specialty crops are the vegetables and fruits that generally require intensive management. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic.

soil descriptions

areas dominated by nearly level, very poorly drained and somewhat poorly drained soils; on outwash plains, till plains, lake plains, and bottom land

These soils are on bottom land and in depressions of uplands. They are scattered throughout the county.

These areas make up about 31 percent of the county. They are used for cultivated farm crops because most areas are drained. Most of these areas are generally not suited to urban uses because wetness, flooding, or high organic matter content are limitations.

1. Gilford-Maumee-Sebewa

Nearly level, very poorly drained soils that formed in loamy and sandy sediment

This map unit consists of nearly level soils. Topography is almost flat (fig. 2). The areas are large and are in the southern part of the county. Most areas of this unit are drained by open ditches. Slope ranges from 0 to 2 percent.

This map unit makes up about 13 percent of the county. It is about 54 percent Gilford soils and similar soils, 15 percent Maumee soils, and 10 percent Sebewa soils. The remainder is soils of minor extent.

The very poorly drained Gilford soils are in broad areas of the landscape. They have a surface soil of very dark gray fine sandy loam and sandy loam and a subsoil of dark gray, mottled sandy loam.

The very poorly drained Maumee soils are also in broad areas of the landscape. They have a surface soil of black and very dark gray loamy fine sand over dark gray and light brownish gray, mottled sand.

The very poorly drained Sebewa soils are in broad areas that are slightly depressional, or they are in swales along poorly defined drainageways. They have a surface soil of black and very dark brown loam and clay loam and a subsoil of gray and grayish brown, mottled clay loam and sandy clay loam.

The minor soils are the somewhat poorly drained Bourbon and Morocco soils, which are on slightly higher parts of the landscape; the poorly drained Pinhook soils, which are above the Bourbon and Morocco soils; and the finer textured Warners soils that are in the deeper depressions.

Most of the acreage has been cleared and is used for cultivated farm crops. Most of the cropped areas have been drained. Most swampy areas and sandy ridges are in woodland or pasture.

When adequately drained, these soils are suited to cultivated farm crops. Ponding is the main limitation and is common in winter and spring.

The soils in this unit are poorly suited to trees. Only trees that are tolerant of wetness grow on these soils.

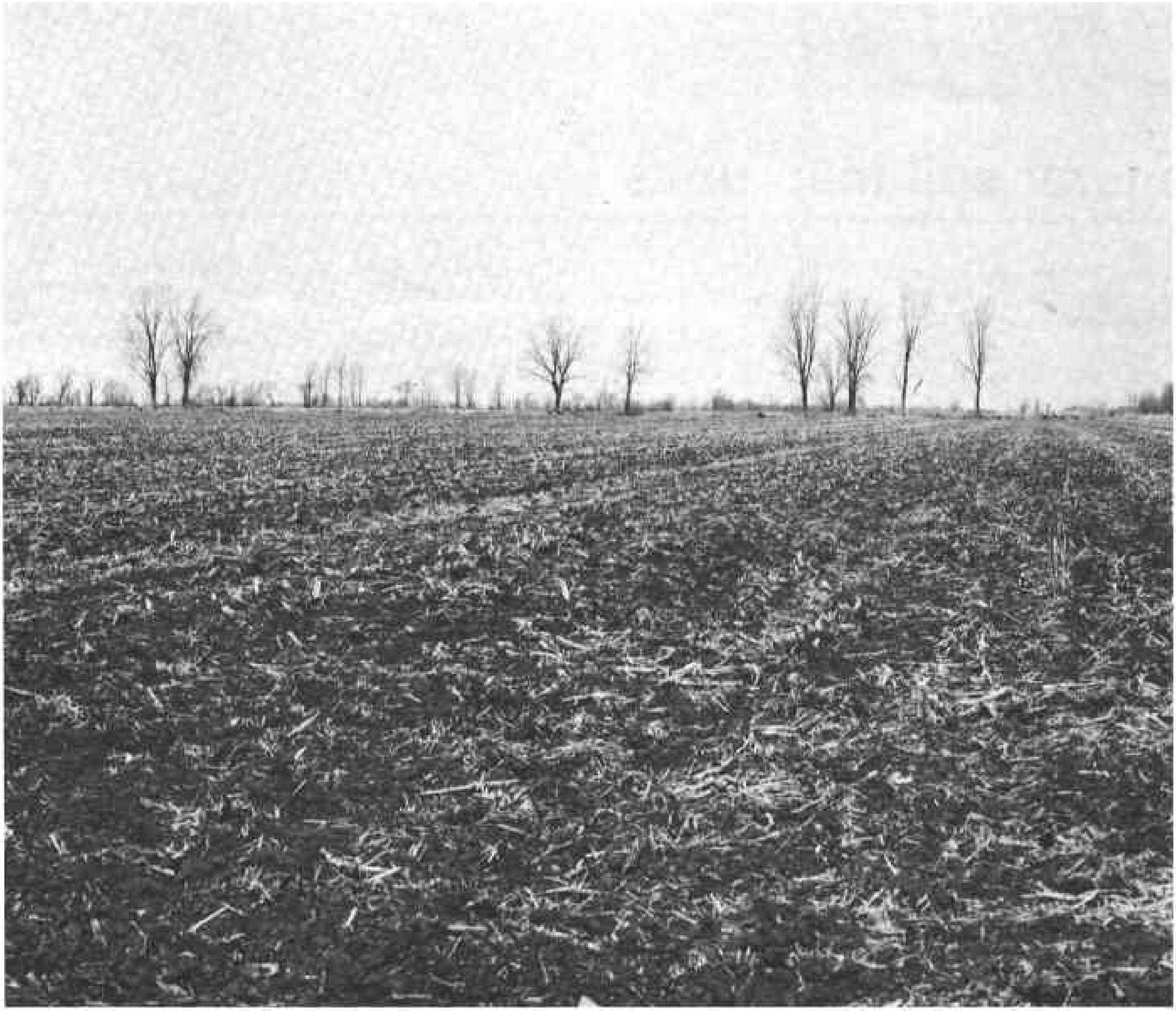

Figure 2.—A landscape of Gilford soils that are nearly level, typical of the topography in the southern part of the county.

The ponding restricts harvesting to extremely dry seasons or to periods when the ground is frozen.

This unit is generally not suited to sanitary facilities and building site developments. The main limitations are ponding and pollution of ground water. Effluent from waste disposal facilities can pollute ground water where the soils have underlying sand. The sand has poor filtering qualities.

2. Cohoctah-Fluvaquents-Suman

Nearly level, very poorly drained and somewhat poorly drained soils that formed in loamy and sandy alluvium

This map unit consists of bottom land that is characterized by an almost flat topography. The areas are elongated and usually fairly narrow. They are along the Galena and Kankakee Rivers and along Kingsbury Creek, Mill Creek, and Trail Creek. Slope ranges from 0 to 2 percent.

This map unit makes up about 7 percent of the county. It is about 18 percent Cohoctah soils and similar soils, 16 percent Fluvaquents, and 10 percent Suman soils. The remainder is soils of minor extent.

The very poorly drained Cohoctah soils are in the more depressional areas. These soils are along the creeks that flow into the Kankakee River and are along the river. They have a surface soil of black sandy loam underlain by black loam that has strata of grayish brown and brown fine sand and loamy sand.

Fluvaquents soils are on slightly higher-lying flats and slight rises in the landscape. They are dominantly somewhat poorly drained and have a surface layer that is dark gray or dark grayish brown, mottled loam or silt loam and a subsoil that varies in texture.

The very poorly drained Suman soils are in depressional areas in swales and along poorly defined drainageways. They have a surface soil of black and very dark gray silty clay loam and a subsoil of dark gray, mottled clay loam.

The minor soils are the very poorly drained Gilford and Maumee soils in larger depressional areas farther from the streams; the very poorly drained Maumee Variant that has shells throughout the profile; and the very poorly drained Adrian and Wallkill soils that are in deeper depressions of organic material.

Most of the acreage of this unit has been cleared and is used for cultivated crops. Most cropped areas have been drained. A few swampy areas are in woodland or pasture.

When adequately drained, these soils are suited to cultivated farm crops. Wetness and the hazard of flooding are the main limitations. Flooding is common in winter and spring.

The soils in this unit are poorly suited to trees. Only trees that are tolerant of wetness grow on these soils. The wetness and flooding restrict harvesting to extremely dry seasons or periods when the ground is frozen.

This unit is generally not suited to sanitary facilities and building site developments. The main limitations are flooding, wetness, and pollution of ground water. Effluent from waste disposal facilities can pollute ground water where the soils have a sandy substratum.

3. Adrian-Houghton-Edwards

Nearly level, very poorly drained soils that formed in organic material over sand and marl

This map unit consists of deposits of muck that are within large depressions.

This map unit makes up about 11 percent of the county. It is about 33 percent Adrian soils and similar soils, 31 percent Houghton soils, and 11 percent Edwards soils. The remainder is soils of minor extent.

The Adrian soils are in the shallower part of the depressional areas or are near the edge of the deeper mucks. They cannot be differentiated from the other muck soils by sight. The organic layer is 16 to 51 inches thick. The surface soil is black muck over a very dark brown muck. Below this is sand.

The Houghton soils are in the deepest depressions or are in the deeper part of the depressional area. They cannot be differentiated from the other muck soils by sight. The organic layer is more than 51 inches thick. The surface layer is black muck over layers of very dark brown and very dark grayish brown muck.

The Edwards soils are also in the somewhat shallower part of depressional areas or are near the edge of units of deeper mucks. They cannot be differentiated from the other muck soils by sight. The organic layer is 16 to 51 inches thick. The surface layer is black muck over layers of black and very dark gray muck. Marl is below the organic layer.

The minor soils are the very poorly drained Martisco soils that have thin muck layers over marl; the very poorly drained Maumee soils that are sandy throughout; the very poorly drained Muskego soils that are muck over coprogenous earth; and the very poorly drained Palms soils that are muck over loamy mineral materials.

Most of the acreage of this unit has been cleared and drained and is used for cultivated crops. Most swampy areas are in water-tolerant trees and shrubs. Cattails and other water-tolerant herbaceous plants grow in some swampy areas.

When adequately drained, these soils are suited to cultivated farm crops. Ponding is the main limitation of these soils for farming. It is common in winter and spring (fig. 3).

The soils in this unit are poorly suited to trees. Only trees that are tolerant of wetness grow on these soils. The ponding restricts harvesting to extremely dry seasons or periods when the ground is frozen.

This unit is generally not suited to sanitary facilities and building site developments. The main limitations are ponding, pollution of ground water, excess humus, and low strength. Effluent from waste disposal facilities can pollute ground water in areas where the soils have a sandy substratum.

areas dominated by nearly level and gently sloping, poorly drained to moderately well drained soils; on outwash plains, valley trains, and lake plains

These nearly level and gently sloping soils are on uplands in the southwestern part of the county.

These areas make up about 8 percent of the county. Most of the areas are drained and are used for cultivated farm crops. The areas have poor potential for urban uses because the soils are limited by wetness.

4. Bourbon-Hanna-Pinhook

Nearly level and gently sloping, poorly drained to moderately well drained soils that formed in loamy and sandy outwash sediment

This map unit consists of nearly level and gently sloping soils on outwash plains, valley trains, and lake plains. Most areas of this unit are drained by open ditches and subsurface drains. The largest area of the unit is in the southwestern part of the county. Slope ranges from 0 to 3 percent.

This map unit makes up about 8 percent of the county. It is about 47 percent Bourbon soils and similar soils, 33 percent Hanna soils, and 15 percent Pinhook soils. The remainder is soils of minor extent.

Figure 3.—Flooded farmland of Adrian and Houghton mucks near the Kankakee River. Heavy spring rains have filled the drainage ditches.

The somewhat poorly drained Bourbon soils are on slightly convex, broad flats and slight rises in the landscape. They have a surface layer of very dark grayish brown sandy loam and a subsoil of brown, yellowish brown, and light brownish gray sandy loam and shaly sandy loam that is mottled.

The moderately well drained Hanna soils are in the higher lying broad areas. They have a surface layer of dark grayish brown sandy loam, a subsurface layer of dark brown sandy loam, and a subsoil of dark brown, dark yellowish brown, brown, and dark yellowish brown and light brownish gray sandy loam and loam that is mottled in the lower part. Below this is mottled yellowish brown, gray, and grayish brown stratified loamy sand, sand, and sandy loam.

The poorly drained Pinhook soils are in small areas of slightly lower and slightly concave flats. They have a surface layer of very dark gray loam, a subsurface layer of gray loam, and a subsoil of gray and strong brown, mottled loam, sandy loam, shaly sandy loam, and loamy sand.

The minor soils are the very poorly drained Gilford and

Sebewa soils in depressional areas along poorly defined drainageways. The well drained Tracy soils are on knobs and side slopes along drainageways.

Most of the acreage of this unit has been cleared and drained and is used for cultivated farm crops.

When adequately drained, these soils are suited to cultivated farm crops. Wetness is the main limitation. Some of the minor soils are ponded in winter and spring.

The soils in this unit are suited to trees that are tolerant of wetness. Wetness is the main limitation. It restricts harvesting operations to drier periods of the year or to periods when the ground is frozen.

This unit is poorly suited to sanitary facilities and building site developments. The main limitations are wetness and pollution of ground water. Effluent from waste disposal facilities can pollute ground water because the sandy part of the soils has poor filtering qualities.

areas dominated by nearly level to very steep, well drained and excessively drained soils; on outwash plains and uplands

These nearly level to very steep soils are on outwash plains and windblown plains and ridges.

These areas make up about 31 percent of the county. They are used for cultivated farm crops and some woodland. These areas have good potential for urban uses.

5. Tracy-Chelsea

Nearly level to very steep, well drained and excessively drained soils that formed in loamy and sandy outwash and eolian material

This map unit consists of nearly level to very steep soils on outwash plains and eolian uplands. The glacial outwash plains are rolling to steep and are dissected by drainageways. The windblown sands are on nearly level plains to strongly sloping ridges. These areas are large and are scattered throughout the county. Slope ranges from 0 to 45 percent.

This map unit makes up about 31 percent of the county. It is about 47 percent Tracy soils and similar soils and 14 percent Chelsea soils. The remainder is soils of minor extent.

The well drained Tracy soils are nearly level to very steep. They are on higher lying parts of outwash plains. They have a surface layer of dark brown sandy loam and a subsoil of dark brown sandy loam, loam, gravelly sandy clay loam, and gravelly sandy loam.

The excessively drained Chelsea soils are gently sloping to strongly sloping. They are in rolling sandy areas. They have a surface layer of very dark gray fine sand and a subsurface layer of dark brown, dark yellowish brown, and light yellowish brown fine sand. Below this is light yellowish brown fine sand that has thin bands of dark brown loamy sand.

The minor soils are the somewhat excessively drained Tyner soils and the well drained Elston soils that are nearly level or gently sloping; the moderately well drained Hanna soils that are nearly level and gently sloping and are in slightly lower parts of the landscape; the somewhat poorly drained Bourbon soils on the low lying, concave, broad flats; the poorly drained Quinn soils on low lying, broad flats; the very poorly drained Gilford and Washtenaw soils along poorly defined drainageways and in low lying pockets; and the ponded Histosols and Aquolls in bogs and swamps.

Most of the acreage of this unit has been cleared and is used for cultivated farm crops and specialty crops. Slope, droughty conditions, and the hazard of erosion are the main limitations. Some of the swampy and undrained parts of the landscape and most of the rough, steep parts have remained uncleared. They are generally in mixed hardwoods.

The soils in this unit are suitable for trees. There are few limitations for equipment or harvesting.

This unit is poorly suited to sanitary facilities. Some areas are poorly suited to building site developments. Slope and pollution of ground water are the main limitations. Effluent from waste disposal facilities can pollute ground water.

areas dominated by nearly level and gently sloping, well drained soils; on outwash plains

These nearly level or gently sloping soils are on outwash plains in the central part of the county.

These areas make up about 13 percent of the county. They are used for cultivated farm crops. These areas have good potential for urban uses.

6. Elston-Coupee

Nearly level and gently sloping, well drained soils that formed in sandy and loamy outwash sediment

This map unit consists of nearly level and gently sloping soils. The areas are large and are located in the central part of the county. Slope ranges from 0 to 6 percent.

This map unit makes up about 13 percent of the county. It is about 53 percent Elston soils and similar soils and 32 percent Coupee soils. The remainder is soils of minor extent.

The well drained Elston soils are nearly level or gently sloping. They have a surface layer of black loam, a subsurface layer of black and very dark grayish brown loam, and a subsoil of dark yellowish brown sandy loam and loamy sand.

The well drained Coupee soils are nearly level or gently sloping. They have a surface layer of very dark brown silt loam, a subsurface layer of very dark brown and dark brown silt loam, and a subsoil of dark yellowish brown clay loam, loam, sandy loam, and shaly loamy sand.

The minor soils are the well drained Tracy soils which are on the flats and side slopes and which do not have a deep, dark surface layer; the well drained Troxel soils that are in potholes and swales; and the very poorly drained Gilford soils and the poorly drained Washtenaw soils in deeper depressions, in low lying pockets, and along poorly defined drainageways.

Most of the acreage of this unit is used for cultivated farm crops. Some areas are used for residential developments and other urban related uses.

These soils are suited to cultivated farm crops. Droughtiness and the acid conditions of these soils are the main limitations for growing crops.

The soils in this unit are suited to trees; however, trees are not native to these soils. These soils have few limitations for logging operations.

This unit is poorly suited to sanitary facilities, but most areas are suited to building site development. The main limitation for waste disposal facilities is pollution of ground water by effluent.

areas dominated by nearly level to very steep, well drained soils; on till plains and moraines

These gently sloping to very steep soils are on glacial uplands in the northern part of the county.

These areas make up about 7 percent of the county. They are in woodland, pasture, and some cultivated farm crops. They have fair potential for urban uses.

7. Riddles

Nearly level to very steep, well drained soils that formed in loamy glacial till

This map unit consists of nearly level or gently sloping soils on knolls and ridges and moderately sloping to steep soils on side slopes. In some areas the Riddles soils are nearly level and on convex plains which have rolling topography and which can join hummocky areas. This unit is a narrow area that crosses the county from east to west in the northern part. These soils are drained by small streams. Slope ranges from 0 to 45 percent.

This map unit makes up about 7 percent of the county. It is about 85 percent Riddles soils and similar soils. The remainder is soils of minor extent.

The well drained Riddles soils are on nearly level or hummocky till plains and on very steep side slopes of ridges, of deep potholes, and along streams. They have a surface layer of dark grayish brown loam and a subsoil of brown, yellowish brown, and dark brown loam, clay loam, and sandy clay loam.

The minor soils are the well drained Tracy soils and the well drained and moderately well drained Morley soils on the till plains and on ridges and side slopes; the somewhat poorly drained Blount soils on the low, broad flats; the very poorly drained Pewamo soils and the poorly drained Washtenaw soils in depressional areas, in swales, in pockets, and along poorly defined drainageways; and the ponded Histosols and Aquolls in bogs and swamps.

This unit is used mainly for woodland and pasture. The nearly level and gently sloping soils that are large enough for cropland have been cleared and are farmed (fig. 4). Some of the swampy undrained areas are in trees.

The nearly level to moderately sloping soils are suited to cultivated farm crops. Slope and the hazard of erosion are the main limitations. The steeper sloping soils are suited to permanent pasture.

These soils are suited to trees. Some areas are used for orchards. The steepness of slope restricts the use of logging equipment, and erosion is a hazard along logging roads and skid trails.

This unit is fairly well suited to sanitary facilities and building site development. Slope and moderate permeability and moderately slow permeability are the main limitations. Additional limitations are shrink-swell potential and seepage. Erosion needs to be controlled during and after construction.

areas dominated by nearly level and gently sloping, somewhat poorly drained soils; on till plains and lake plains

These nearly level and gently sloping soils are on till plains and lake plains in the northwestern part of the county.

These areas make up about 5 percent of the county. They are used for cultivated farm crops; however, a few areas are wooded. These areas have poor potential for urban uses.

8. Blount-Selfridge

Nearly level and gently sloping, somewhat poorly drained soils that formed in loamy glacial till and in sandy deposits over loamy material

This map unit is on till plains, lake plains, and moraines that are characterized by a topography of gentle swales and swells. It is located in the northwestern part of the county. Most soils are drained by small streams and by some ditches. Slope ranges from 0 to 6 percent.

This map unit makes up about 5 percent of the county. It is about 56 percent Blount soils and similar soils and 15 percent Selfridge soils. The remainder is soils of minor extent.

The somewhat poorly drained Blount soils are on higher lying, broad, slightly convex flats and slight rises in the landscape. They have a surface layer of dark grayish brown silt loam and a subsoil of yellowish brown and dark yellowish brown, mottled silty clay loam and clay loam.

The somewhat poorly drained Selfridge soils are also on higher lying, broad flats and gently sloping rises in the

Figure 4.—A landscape of the Riddles General Soil Map Unit that is cultivated and wooded. Tracy and Chelsea soils, in the background, are cropped.

landscape. They have a surface layer of dark grayish brown loamy fine sand and a subsoil of yellowish brown, mottled loamy fine sand; pale brown sand; dark yellowish brown, mottled sandy loam; and brown and dark grayish brown, mottled clay loam.

The minor soils are the somewhat poorly drained Homer soils on slight rises in areas near older drainageways; the somewhat poorly drained Morocco soils on slight rises in sandy areas; the very poorly drained Milford soils and very poorly drained Pewamo soils in depressions; and the very poorly drained Cheektowaga and Newton soils on low lying flats, in swales, and along poorly defined drainageways.

Most of this unit has been cleared and drained and is used for cultivated farm crops. The undrained areas are in woodland or pasture.

The drained areas that are cleared are suited to cultivated farm crops. Wetness and ponding are the main limitations.

The soils in this unit are suited to trees. Trees that are tolerant to wetness should be considered for planting. The wetness and ponding of the soils restrict harvesting to dry periods or periods when the ground is frozen.

This unit is poorly suited to sanitary facilities and building site developments. Slow permeability or moderately slow permeability, ponding, and wetness are the main limitations. Seepage is a limitation for sanitary facilities on the Selfridge soil.

areas dominated by nearly level to moderately steep, well drained to somewhat poorly drained soils; on outwash plains, sand dunes, and beach ridges

These nearly level to moderately steep soils are on beach ridges, sand dunes, and outwash plains in the northern part of the county.

These areas occupy about 5 percent of the county. They are primarily urban land. They have fair potential for cultivated farm crops.

9. Oakville-Morocco-Brems

Nearly level to moderately steep, well drained to somewhat poorly drained soils that formed in sandy outwash and eolian material

This map unit is nearly level to moderately steep. The areas are characterized by alternating high ridges and flats that have a topography of gradual swales and swells. The high ridges are old, wind-blown dunes that have been stabilized by trees. The areas are large and are near Lake Michigan. Slope ranges from 0 to 25 percent.

This map unit makes up about 5 percent of the county. It is about 28 percent Oakville soils and similar soils, 25 percent Morocco soils, and 17 percent Brems soils. The remainder is soils of minor extent.

The well drained Oakville soils are on ridges, old dunes, and higher swells. They have a surface layer of black fine sand, a subsurface layer of dark grayish brown fine sand, and a subsoil of yellowish brown fine sand.

The somewhat poorly drained Morocco soils are on low lying flats. They have a surface layer of very dark gray loamy fine sand and a subsurface layer of yellowish brown loamy fine sand. The subsoil is yellowish brown, mottled loamy fine sand and pale brown and very pale brown, mottled fine sand.

The moderately well drained, nearly level Brems soils are on the slight rises of beach ridges and sandy outwash plains. They have a surface layer of dark grayish brown fine sand and a subsoil of yellowish brown, mottled sand.

The minor soils are the somewhat poorly drained Saugatuck soils which have a subsoil of cemented sand and which are on broad flats; the somewhat poorly drained Pipestone soils that have a spodic horizon and are in slightly higher parts of the landscape than the Saugatuck soils; the very poorly drained Newton soils in depressions and along poorly defined drainageways; the very poorly drained Adrian soils which are muck soils over sand and which are in the deeper depressions; and the somewhat poorly drained Selfridge soils which are sandy in the upper part and clayey in the lower part and which are on flats and slight rises in the landscape.

Most of this unit is in woodland or is urban land. Most areas are generally in mixed hardwoods.

The steeper soils have poor potential for cultivated farm crops because the slope and droughtiness are limitations. If these soils are cleared, the sands are subject to moving and shifting by the wind. The soils in the low lying areas are wetter and require drainage to be suitable for cultivated farm crops.

The soils in this unit are suited to trees. The steep, sandy soils restrict the use of logging equipment. The low, wet soils restrict the use of logging equipment to periods when they are dry or when the ground is frozen. Erosion is a problem along logging roads and skid trails.

This unit is poorly suited to sanitary facilities and building site developments. The main limitations are slope and pollution of ground water. Effluent from waste disposal facilities can cause pollution of ground water because the sand has poor filtering qualities. The instability of the sands on the slopes can be a limitation for building site developments.

broad land use considerations

Each year a considerable amount of land is being developed for urban uses in La Porte and Michigan City, and in Center, Coolspring, Kankakee, Michigan, Pleasant, Scipio, and Springfield townships. About 128,241 acres, or nearly 33 percent of the survey area, is urban or built-up land (*3*). The general soil map is most helpful for planning the general outline of urban areas; however, it cannot be used for the selection of sites for specific urban structures. The data about specific soils in this survey area can be helpful in planning future land use patterns.

Areas where the soils are so unfavorable that urban development is not desirable or is nearly prohibitive are extensive in the survey area. The Cohoctah-Fluvaquents-Suman map unit is on flood plains, and flooding is a severe hazard. The Adrian-Houghton-Edwards map unit is made up of organic soils and has a severe hazard of flooding, a high water table, and instability of the organic matter. Also, an extensive drainage system is required for urban development on the wet soils in the Gilford-Maumee-Sebewa map unit, the Bourbon-Hanna-Pinhook map unit, and the Blount-Selfridge map unit. The steeper sloping Tracy and Chelsea soils in the Tracy-Chelsea map unit, the steeper sloping Riddles soils in the Riddles map unit, and the steeper sloping Oakville soils in the Oakville-Morocco-Brems map unit are severely limited for urban development.

The Tracy-Chelsea map unit, the Elston-Coupee map unit, and the Riddles map unit have many sites on more nearly level soils that can be developed for urban uses at lower costs than the soils named above. Most of these soils are well suited to urban development. In addition, the Tracy, Elston, and Coupee soils are good farm land, and this potential should not be overlooked when broad land uses are considered.

The Gilford-Maumee-Sebewa, Adrian-Houghton-Edwards, Bourbon-Hanna-Pinhook, Elston-Coupee, and Blount-Selfridge map units on the general soils map have good potential for cultivated farm crops. These soils have fair or poor potential for urban uses because wetness is a severe limitation. With proper subsurface and surface drainage, wetness can be overcome on most of these soils. It should be noted, however, that many farmers have drained these soils and are growing crops on them.

Some of the soils, such as those in the Riddles map unit and the Blount-Selfridge map unit, are severely limited by the amount of silt and clay in the soil. Organic soils like the Adrian-Houghton-Edwards map unit are severely limited by wetness and the low bearing strength of the organic material.

Most of the soils of the county have good or fair potential for woodland. Commercially valuable trees are the most commonly grown. Generally they grow more rapidly on the well drained soils of the Riddles and the Elston-Coupee map units than they do on the wetter soils in the other units.

detailed soil map units

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

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

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

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

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

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

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Urban land-Coupee complex is an example.

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

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

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

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

soil descriptions

Ad—Adrian muck, drained. This nearly level or depressional soil is deep and very poorly drained. The soil is in old lake basins on the outwash plains and along some established ditches. It is frequently ponded by surface runoff from adjacent higher lying parts of the landscape. Individual areas are irregular in shape. They range from 5 to 100 acres in size but are dominantly about 25 acres.

In a typical profile the surface layer is black muck about 8 inches thick. The underlying organic material is about 24 inches of black and very dark brown muck. The substratum is dark gray sand and loamy sand to a depth of 60 inches. In some small areas the muck is less than 16 inches thick or more than 51 inches thick. In some small areas the mineral material below the organic layer is loamy rather than sandy. In some areas the substratum is alternating bands of organic material and sand. In others it is coprogenous earth above the sand.

Included with this soil in mapping are areas of very poorly drained Adrian soils that have not been drained. This inclusion makes up about 8 percent of the unit.

This Adrian soil has very high available water capacity. It is moderately slowly permeable to moderately rapidly permeable in the organic material and rapidly permeable in the substratum. Surface runoff is very slow or ponds.

A high water table is at or above the surface during much of the year. The surface layer is friable and has good tilth. It is very high in organic matter.

Most areas of this soil are used for cultivated crops. A few areas are used for pasture.

This soil is suited to growing corn, soybeans, and specialty crops. Wetness and wind erosion are limitations in use and management of this soil. When the soil is adequately drained, row crops can be grown most of the time. Soybeans are difficult to grow and harvest because of weeds. Conservation tillage, using crop residue in or on the plow layer, and a cover crop of grasses, legumes, or small grain help control wind erosion and maintain tilth and organic matter content.

This soil is suited to grasses for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture in good condition.

This soil is poorly suited to growing trees for wood production. The water table at or near the surface is the main limitation. Equipment limitations, seedling mortality, and windthrow hazard are severe and are difficult to overcome. Undrained areas are in water-tolerant shrubs and trees.

This soil is generally not suitable for building sites because ponding and the low strength of the organic material are limitations. Ponding, frost action, and low strength severely limit this soil for local roads. If roads are constructed, the organic material should be removed and a suitable material used as fill to raise and strengthen the base. Lowering the water table by artificial drainage is a practice that is used to reduce the frost action. This soil is generally not suitable for septic tank absorption fields because ponding and poor filtering qualities are limitations for this use.

This soil is in capability subclass IVw and woodland suitability subclass 4w.

BaA—Blount silt loam, 0 to 3 percent slopes. This nearly level and gently sloping soil is deep and somewhat poorly drained. It is on glacial till plains. Individual areas are broad and irregular in shape. They range from 10 to 160 acres in size but are dominantly about 20 acres.

In a typical profile the surface layer is dark grayish brown silt loam about 9 inches thick. The yellowish brown, mottled subsoil is about 33 inches thick. The upper part is firm silty clay loam, and the lower part is firm and very firm clay loam. The substratum is yellowish brown, mottled clay loam to a depth of 60 inches. In places the solum is more than 45 inches thick. In some small areas the upper horizons have more sand.

Included with this soil in mapping are a few small areas of very poorly drained Pewamo soils in slight depressions. There are also well drained and moderately well drained Morley soils on knolls. These inclusions make up about 10 to 12 percent of the unit.

This Blount soil has moderate available water capacity and is slowly permeable or moderately slowly permeable. Surface runoff is slow or medium. This soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring. The surface layer is generally strongly acid, unless it is limed. It is friable and easily tilled throughout a moderate range of moisture content. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few areas are in woodland. Some urban development has taken place on this soil in the northern part of the county.

This soil is well suited to growing corn, soybeans, and small grain. Row crops can be grown most of the time. Wetness is the main limitation in use and management of this soil. This soil should not be worked when wet because of puddling. Subsurface drainage, conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content of the soil.

This soil is suited to growing grasses and legumes for hay or pasture. When the soil is adequately drained, yields can be greatly increased. Deep rooted legumes, such as alfalfa, are not as well suited to this soil as shallow-rooted legumes. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help reduce surface compaction and maintain good tilth and density of plants.

This soil is suited to growing trees; however, only a few areas are in woodland. The hazards of seedling mortality and windthrow are severe. Some replanting of seedlings might be necessary. Survival and growth of seedlings are improved if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited for building sites by wetness. An adequate drainage system is needed to satisfactorily lower the water table. Water moves slowly to drainage systems because of the slow permeability or moderately slow permeability of the soil. Dwellings should be constructed without basements. Frost action and low strength are severe limitations of this soil for local roads and streets. Drainage ditches along the roads to lower the water table help reduce the potential for frost action. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps support vehicular traffic. This soil is severely limited for septic tank absorption fields by wetness and slow absorption of liquid waste. Enlarging the absorption field and providing drainage help overcome these limitations.

This soil is in capability subclass IIw and in woodland suitability subclass 3c.

Br—Bourbon sandy loam. This nearly level soil is deep and somewhat poorly drained. It is on outwash plains. Individual areas are irregular in shape and range from 5 to 100 acres in size but are dominantly about 45 acres.

In a typical profile the surface layer is very dark grayish brown sandy loam about 9 inches thick. The subsoil is about 32 inches thick. The upper part is brown, mottled, friable sandy loam, and the lower part is yellowish brown and light brownish gray, mottled shaly sandy loam. The substratum is grayish brown, mottled, stratified sand and shaly and gravelly sand to a depth of 60 inches. In some areas the solum is less than 40 inches thick. In some areas the surface layer is brown, and in some areas the subsoil has more clay.

Included with this soil in mapping are small areas of very poorly drained Gilford soils and poorly drained Pinhook soils that are in depressions and drainageways and the well drained Tracy soils that are at higher elevations. These inclusions make up about 12 to 15 percent of the unit.

This Bourbon soil has low available water capacity and is moderately rapidly permeable. Surface runoff is slow. This soil has a high water table that is at a depth of 1 foot to 3 feet during winter and spring. The surface layer is strongly acid in unlimed areas. It is friable and easily tilled. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture, and some are in woodland.

This soil is suited to growing corn, soybeans, and small grain. Wetness is the major limitation in the use and management of this soil. The soil blows during dry periods. When the soil is adequately drained, a cropping system can include row crops most of the time. Conservation tillage, using crop residue in and on top of the plow layer, and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content and help control wind erosion.

This soil is well suited to growing grasses and legumes for hay or pasture. Draining this soil is beneficial in attaining high yields for forage or pasture. Pasture also helps control wind erosion. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because the high water table is a limitation. When the soil is used for pasture, the major concern of management is overgrazing. Overgrazing can cause wind erosion and can reduce the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet and very dry periods help keep the pasture and soil in good condition.

This soil is suited to growing trees, but only a few areas are in woodland. Plant competition is moderate. Seedlings survive and grow well when competing vegetation is controlled. The control or removal of unwanted trees and shrubs can be accomplished by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites and septic tank absorption fields by wetness. An adequate drainage system is needed to satisfactorily lower the water table. Dwellings should be constructed without basements. Poor filtering qualities are a severe limitation for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies can become a problem. Frost action severely limits this soil for local roads and streets. Drainage ditches along the roads lower the water table, which reduces the potential for frost action.

This soil is in capability subclass IIw and in woodland suitability subclass 3o.

BtA—Brems fine sand, 0 to 3 percent slopes. This nearly level and gently sloping soil is deep and moderately well drained. The soil is on outwash plains. Individual areas are irregular to elongated in shape. They range from 5 to 600 acres in size but are dominantly about 25 acres.

In a typical profile the surface layer is dark grayish brown fine sand about 9 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, loose sand, and the lower part is yellowish brown, mottled, loose sand. Between depths of 37 and 50 inches the substratum is very pale brown sand. The lower part of the substratum is brownish yellow, mottled sand to a depth of 60 inches. In some places the solum is less than 35 inches thick. In some areas the soil has a high water table but does not have grayish mottles. In others thin bands of loamy sand and sandy loam are in the lower part of the subsoil.

Included with this soil in mapping are some small areas of Bourbon and Hanna soils. Also included are some small areas of Tyner soils that are on slightly higher parts of the landscape. These inclusions make up about 8 to 15 percent of the unit.

The Brems soil has low available water capacity and is rapidly permeable. Surface runoff is slow. A seasonal high water table is at a depth of 2 or 3 feet during winter and spring. The surface layer is generally strongly acid, unless it is limed. It is very friable and has good tilth but is low in organic matter content.

Some areas of this soil are used for cultivated crops. Others are used for hay or pasture or are in woodland.

This soil is suited to growing corn, soybeans, and small grain. Droughtiness and wind erosion are the main limitations in use and management of this soil.

Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of legumes, grasses, or small grain help improve and maintain tilth and organic matter content in this soil.

This soil is suited to deep rooted legumes and drought-tolerant grasses for hay or pasture. Shallow rooted legumes, such as clover, are poorly suited to this soil because of the low available water capacity. When this soil is used for pasture, the major concern of management is overgrazing, which reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, and timely deferment of grazing during dry periods help to keep the pasture and soil in good condition.

This soil is suited to growing trees. It is limited severely by seedling mortality. Some replanting of seedlings might be necessary. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

The wetness of this soil is a moderate limitation for houses without basements and a severe limitation for dwellings with basements. The soil is moderately limited for local roads and streets by wetness. The water table can be lowered by a drainage system. This soil is severely limited for septic tank absorption fields by wetness and poor filtering qualities. Ground water supplies can be polluted.

This soil is in capability subclass IVs and woodland suitability subclass 3s.

Cd—Cheektowaga fine sandy loam. This nearly level or depressional soil is deep and very poorly drained. It is in narrow drainageways and low parts of lake plains and till plains. It is frequently ponded by runoff from adjacent, higher lying parts of the landscape. Individual areas are small and are generally elongated. They range from 3 to 25 acres in size.

In a typical profile the surface layer is very dark gray fine sandy loam about 13 inches thick. The subsoil is about 17 inches thick. The upper part is gray and light brownish gray, mottled fine sand and loamy fine sand and the lower part is dark gray, mottled, friable fine sandy loam. The substratum is yellowish brown and grayish brown, mottled silty clay to a depth of 60 inches. In a few small areas, the surface layer is sandy, and in some areas the subsoil is sandy loam.

Included with this soil in mapping are a few small areas of somewhat poorly drained Selfridge soils on slightly higher parts of the landscape. This inclusion makes up 5 to 8 percent of the unit.

This Cheektowaga soil has moderate available water capacity. It is rapidly permeable in the upper part of the solum and is slowly or very slowly permeable in the lower part of the solum and the substratum. Surface runoff is very slow or ponds. This soil has a prolonged seasonal high water table at or near the surface in early spring. The surface layer is friable and easy to till under proper moisture conditions. It is high in organic matter content.

Some areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woods.

This soil is suited to growing corn, soybeans, and some small grain. It is poorly suited to winter wheat because ponding usually destroys stands. Wetness is the main limitation that affects the use and management of this soil. Excessive water can be removed by open ditches; by subsurface drains where the upper, rapidly permeable sandy layer is thick enough; by surface drains; by pumps; or by a combination of these practices. Where drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage and using crop residue in and on top of the plow layer help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. When this soil is adequately drained, yields can be greatly increased. Deep rooted legumes, such as alfalfa, are not as well suited to this soil as shallow rooted legumes. When this soil is used for pasture, the main concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to growing trees. The use of equipment is severely limited by wetness. Seedling mortality, windthrow hazard, and plant competition are severe because the seasonal high water table is at or near the surface for long periods of time. Trees are usually harvested during extremely dry seasons or when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Some replanting of seedlings might be necessary. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is generally not suitable for building sites because water ponds on it. Most areas are difficult to drain. The soil is often in the lowest parts of the landscape. Suitable outlets for drainage systems, such as storm sewers, are often not available, and pumping is needed. Ponding is a severe limitation for local roads and streets. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect roads from ponding. This soil is generally not suitable for septic tank absorption fields because ponding and the slow or very slow permeability are limitations.

This soil is in capability subclass IVw and woodland suitability subclass 5w.

ChB—Chelsea fine sand, 2 to 6 percent slopes. This gently sloping soil is deep and excessively drained. It is on sandy outwash plains and uplands along the eastern side of stream valleys. It is generally on convex summits and side slopes and crests. Individual areas are irregularly shaped but generally are longer than they are broad. They range from 5 to 60 acres in size.

In a typical profile the surface layer is dark grayish brown fine sand about 10 inches thick. The subsurface layer is dark yellowish brown and yellowish brown fine sand about 21 inches thick. Between depths of 31 and 60 inches is dark yellowish brown fine sand and 1/2- to 2 inch-thick bands of dark brown, friable loamy sand and sandy loam. These bands total about 4 inches in thickness. The substratum is grayish brown sand to a depth of 80 inches. In some areas the soil is coarser sand and does not have contrasting bands. In small areas slopes are more than 6 percent.

Included with this soil in mapping are small areas of Riddles and Tracy soils and some small areas of Brems soils that are in slightly lower parts of the landscape. These inclusions make up about 8 to 10 percent of the unit.

This Chelsea soil has low available water capacity and is rapidly permeable. Surface runoff is slow. The surface layer is generally medium acid or strongly acid, unless it is limed. It is very friable and easily tilled. It is low in organic matter content.

Some areas of this soil are used for cultivated crops. Others are used for hay or pasture, and a few are in orchards, vineyards, or woodland.

This soil is suited to growing corn, soybeans, and small grain. Droughtiness and a moderate hazard of wind erosion are the major limitations that affect the use and management of this soil. A cropping system that includes row crops most of the time can be used. Conservation tillage, using crop residue in and on top of the plow layer, and a cover crop of grasses, legumes, or small grain help control wind erosion and improve and maintain tilth and organic matter content.

This soil is suited to deep rooted grasses and legumes for hay or pasture. Shallow rooted legumes, such as clover, are not well suited to this soil because of the low available water capacity. When the soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is suited to growing trees. Seedling mortality is moderate because of this soil's low available water capacity. Tree seedlings should be planted as early as possible in the spring. Some replanting of seedlings might be necessary. Survival and growth of seedlings is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is suitable for dwellings and for local roads and streets. It has severe limitations for septic tank absorption fields because it has poor filtering qualities. Seepage of effluent into ground water supplies can become a problem.

This soil is in capability subclass IVs and woodland suitability subclass 3s.

ChC—Chelsea fine sand, 6 to 12 percent slopes. This moderately sloping soil is deep and excessively drained. It is on sandy outwash plains and uplands. Individual areas are irregularly shaped, but generally they are longer than they are broad. They range from 5 to 30 acres in size.

In a typical profile the surface layer is very dark gray fine sand about 3 inches thick. The subsurface layer is loose fine sand about 33 inches thick. The upper part is dark brown, the middle part is dark yellowish brown, and the lower part is light yellowish brown. Between depths of 36 and 80 inches is light yellowish brown fine sand that has 1/4- to 1 1/2 inch-thick bands of dark brown, friable loamy sand. These bands total about 4 1/2 inches in thickness. In places the bands are sandy loam. In some areas the soil is coarser sand and does not have bands. In others the bands total more than 6 inches in thickness within a depth of 60 inches. In some small areas this soil has slope of less than 6 percent, and in others slope is more than 12 percent.

Included with this soil in mapping are small areas of the less sandy Riddles and Tracy soils. These inclusions make up about 10 to 12 percent of the unit.

This Chelsea soil has low available water capacity and is rapidly permeable. Surface runoff is medium. The surface layer is generally medium acid to strongly acid, unless it is limed. It is very friable and easily tilled. It is low in organic matter content.

Some areas of this soil are used for cultivated crops. Others are used for hay or pasture, and a few are in orchards, vineyards, or woodland.

This soil is poorly suited to growing corn, soybeans, and small grain. Droughtiness and a hazard of erosion caused by the moderate slopes are the major limitations that affect the use and management of this soil. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses or legumes help control erosion and improve and maintain tilth and organic matter content.

This soil is suited to deep rooted grasses and legumes for hay or pasture. Shallow rooted legumes, such as clover, are not well suited to this soil because of the low available water capacity. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing can allow erosion and reduction of the density and hardiness of plants. Proper stocking rates, rotational grazing, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is suited to growing trees. It is limited moderately by the hazard of seedling mortality because of the low available water capacity. Planting tree seedlings should be done as early as possible in the spring. Some replanting of seedlings might be necessary. Survival and growth of seedlings is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is moderately limited for dwellings by slope. Some earthmoving is required to build dwellings. Topsoil should be stockpiled and replaced on disturbed areas and cover established as soon as possible. Slope is a moderate limitation for local roads and streets. Placing roads on the contour of the slope can help overcome this limitation. Poor filtering qualities severely limits this soil for septic tank absorption fields. An alternate site for the septic tank absorption fields should be selected. The number of lines of the septic tank absorption field could be reduced but then lengthened to get the desired size of field, or some lines might need to be placed at greater depths so that all lines receive equal flow. Pollution of ground water supplies can become a problem.

This soil is in capability subclass VIs and woodland suitability subclass 3s.

ChD—Chelsea fine sand, 12 to 18 percent slopes. This strongly sloping soil is deep and excessively drained. It is on sandy outwash plains and uplands. Individual areas are irregularly shaped. They range from 5 to 25 acres in size.

In a typical profile the surface layer is very dark grayish brown fine sand about 3 inches thick. The subsurface layer is dark brown and yellowish brown, loose sand about 22 inches thick. Below this, to a depth of 80 inches, is yellowish brown, loose sand that has bands of dark yellowish brown loamy sand 1/4 inch to 2 inches thick. These bands total about 4 inches in thickness. In some small areas the soil has coarser sand and does not have bands. In others bands total more than 6 inches in thickness within a depth of 60 inches. There are some small areas where slopes are more than 18 percent.

Included with this soil in mapping are some small areas of the less sandy Tracy soils. This inclusion makes up about 5 to 8 percent of the unit.

This Chelsea soil has low available water capacity and is rapidly permeable. Surface runoff is medium. The surface layer is generally medium acid to strongly acid, unless it is limed. It is very friable and easily tilled but is low in organic matter content.

Some areas of this soil are used for hay or pasture; however, most are in orchards, vineyards, or woodland.

This soil is not suited to growing corn, soybeans, and small grain. Droughtiness and a hazard of erosion caused by strong slopes are the major limitations that affect the use and management of this soil.

The use of this soil for grasses and legumes for hay or pasture is effective in controlling wind and water erosion. Shallow rooted legumes, such as clover, are not well suited to this soil because of the low available water capacity. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing can cause erosion and reduce the density and hardiness of plants. Proper stocking rates, rotational grazing, and timely deferment of grazing help keep the pasture and soil in good condition.

This soil is suited to growing trees. It is limited moderately by the hazards of erosion and seedling mortality. Slope is a moderate limitation for the use of equipment. The sandy texture and low available water capacity reduce growth and allow erosion and windthrow. Planting tree seedlings should be done as early as possible in the spring. Some replanting of seedlings might be necessary. Survival and growth of seedlings are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for dwellings by slope. Houses and buildings can be placed on the slopes if foundations and footings are specially designed to prevent structural damage. Large buildings require extensive earthmoving. Slope severely limits this soil for local roads and streets. Placing roads on the contour of the slope can help overcome this limitation. This soil is severely limited for septic tank absorption fields by slope and poor filtering qualities. An alternative site for a septic tank absorption field should be selected. Installations of absorption fields have to be developed parallel to the slope and can require an extended field with some deep trenches to keep the lines level. Pollution of ground water supplies can become a problem.

This soil is in capability subclass VIIs and woodland suitability subclass 3s.

Ck—Cohoctah sandy loam. This nearly level soil is deep and very poorly drained. It is on bottom land, including shallow, abandoned drainageways. It is frequently flooded. Individual areas are large and irregular in shape. They range from 20 to 200 acres in size and are dominantly about 100 acres.

In a typical profile the surface and subsurface layers are black sandy loam. They are about 18 inches thick. Between depths of 18 and 25 inches is black loam that has strata of grayish brown and brown fine sand and loamy sand. The substratum is strong brown loamy sand and thin strata of sand to a depth of 44 inches. Below this, to a depth of 60 inches, it is brown and gray sand that has thin strata of dark gray silt loam. In some small areas the lower horizons do not have stratified layers, and in some areas a dark colored surface layer is less than 10 inches thick. In some areas the substratum has layers of clay loam or sandy clay loam. Narrow areas of light colored sand streak across the landscape.

Included with this soil in mapping are some small areas of the mucky Adrian and Wallkill soils. These inclusions make up about 8 to 12 percent of the unit.

This Cohoctah soil has high available water capacity and is moderately rapidly permeable. The organic matter content of the surface layer is moderate. Surface runoff is very slow, or the soil is ponded. This soil has a prolonged seasonal high water table that is at or near the surface in the spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few are in woodland.

This soil is suited to growing corn, soybeans, and small grain. Wetness is the major limitation in use and management. If this soil has a suitable controlled drainage system, a cropping system can include row crops most of the time. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

This soil is suited to growing grasses and legumes for hay or pasture. Draining this soil is necessary to obtain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because of the high water table. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to growing trees; however, only a few areas are in woodland. Use of equipment is severely limited. This soil is also limited severely by plant competition, seedling mortality, and windthrow hazard. Wetness restricts harvesting of trees to extremely dry seasons or periods when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Some replanting of seedlings might be necessary. Survival and growth of seedlings is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is generally not suitable for building sites or septic tank absorption fields. Wetness and flooding severely limit the soil for these uses. Flooding, wetness, and frost action are severe limitations for local roads. The flooding from the rising water of streams is difficult to overcome. Elevating the roadbed above the high water table with fill material can help reduce the frost action potential.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

CoA—Coupee silt loam, 0 to 2 percent slopes. This nearly level soil is deep and well drained. It is on outwash plains. Individual areas are large and irregular in shape. They range from 20 to 500 acres but are dominantly about 250 acres.

In a typical profile the surface layer is very dark brown silt loam about 13 inches thick. The subsurface layer is dark brown silt loam about 3 inches thick. The dark yellowish brown subsoil is about 29 inches thick. The upper part is firm clay loam and loam, the middle part is friable sandy loam, and the lower part is loose shaly loamy sand. The substratum is light yellowish brown sand to a depth of 60 inches. In some areas sandy material is at a depth of less than 30 inches. Also, in some areas the soil is clay loam to a depth of 48 inches or more, or in some small areas the upper part of the solum has more sand. In small areas slope is more than 2 percent.

Included with this soil in mapping are some small areas of Tracy soils and Troxel soils, which are in depressions or potholes. These inclusions make up about 8 to 12 percent of the unit.

This Coupee soil has moderate available water capacity. It is moderately permeable in the upper part of the solum and is rapidly permeable and very rapidly permeable in the lower part of the solum and in the substratum. Surface runoff is slow. The surface layer is generally strongly acid unless it is limed. It is friable and has good tilth. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. Some urban development has taken place on this soil in the central part of the county.

This soil is suited to growing corn, soybeans, and small grain. Droughtiness and acidity are the major limitations in use and management. A conservation cropping system that includes row crops most of the time can be used. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help maintain and improve organic matter content and maintain tilth.

This soil is well suited to growing grasses and legumes for hay or pasture if it is adequately limed. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is not rated for timber production since trees are not native to these soils.

This soil is suitable for dwellings. Low strength moderately limits this soil for local roads and streets. The base material for roads needs strengthening or replacing with a more suitable material to support vehicular traffic. Poor filtering qualities severely limit this soil for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies can become a problem.

This soil is in capability subclass IIs but is not assigned to a woodland suitability subclass.

CoB—Coupee silt loam, 2 to 6 percent slopes. This gently sloping soil is deep and well drained. It is on outwash plains. Individual areas are generally around potholes and are rather narrow. They range from 5 to 25 acres in size.

In a typical profile the surface layer is black silt loam about 10 inches thick. The subsurface layer is dark brown loam about 6 inches thick. The subsoil is about 26 inches thick. The upper part is dark brown, friable loam, and the lower part is dark yellowish brown, firm clay loam. The substratum is dark brown, stratified gravelly loamy sand and sand to a depth of 60 inches. In some areas the soil is clay loam to a depth of 48 inches or more, or the solum has more sand. In some areas the soil has slopes of less than 2 percent or more than 6 percent.

Included with this soil in mapping are some small areas of Tracy soils and Troxel soils, which are in depressions or potholes. These inclusions make up about 12 to 18 percent of the unit.

This Coupee soil has moderate available water capacity. It is moderately permeable in the upper part of the solum and is rapidly permeable and very rapidly permeable in the lower part of the solum and in the substratum. Surface runoff is medium. The surface layer is generally strongly acid unless it is limed. It is friable and has good tilth. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops, but some are used for hay and pasture. Some urban development has taken place on this soil in the central part of the county.

This soil is suited to growing corn, soybeans, and small grain. Droughtiness, the acidity, and the hazard of erosion are the major limitations in use and management of this soil. A cropping system that includes row crops most of the time can be used. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help maintain and improve organic matter content and maintain tilth.

This soil is well suited to growing grasses and legumes for hay or pasture, if it is adequately limed. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is not rated for timber production because trees are not native to these soils. If trees are planted, they are used for windbreaks.

This soil is suitable for dwellings. It is moderately limited for local roads and streets by low strength. The base material for roads needs strengthening or replacing with a more suitable material to support vehicular traffic. Poor filtering qualities severely limit this soil for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies can become a problem.

This soil is in capability subclass IIe but is not assigned to a woodland suitability subclass.

Du—Duneland. These steep and very steep, low sand dunes and beach ridges are along the shore of Lake Michigan. Individual areas are elongated and continuous along the shore of Lake Michigan.

Included in mapping are some narrow bands of lake beach, some small areas of stabilized sand dunes, and some areas on which houses have been built.

This unit has poor potential for all uses because of the slopes and the instability of the sand. The sands move with the winds and are shifting continuously. There has been some attempt to stabilize the sand by planting beach grasses. The low available water capacity and the continuously shifting sands make it difficult to get any plants to grow in this soil. The slopes and loose sand hinder the use of any equipment.

This unit is not assigned to interpretative groups.

Ed—Edwards muck, drained. This nearly level soil is deep and very poorly drained. It is in depressions within the outwash plains and till plains. It is frequently ponded by surface runoff from adjacent higher lying parts of the landscape. Almost all of this soil has been artificially drained. Individual areas are irregular in shape. They range from 5 to 40 acres but are dominantly about 20 acres.

In a typical profile the surface layer is black muck about 7 inches thick. Under this is about 15 inches of black and very dark gray organic material. The upper part of the substratum, between depths of about 22 to 33 inches, is dark gray marl. Below this is gray marl to a depth of 60 inches. There are some small areas where muck is less than 16 inches thick or more than 51 inches thick. Also individual areas might have coprogenous earth, mineral material, or sand under the organic layer.

Included with this soil in mapping are some small areas of Edwards muck that has not been drained. This inclusion makes up about 3 to 8 percent of the unit.

This Edwards muck has high available water capacity. It is moderately slowly permeable to moderately rapidly permeable in the organic material and variable in the marl. Surface runoff is very slow, or the soil is ponded. This soil has a high water table that is at or above the surface during a considerable part of the year. The surface layer is very strongly acid or strongly acid. It is friable and has good tilth. It is very high in organic matter content.

Most areas of this soil are used for cultivated crops.

This soil is suited to growing corn, soybeans, and specialty crops when it is adequately drained. Wetness and wind erosion are the major limitations in use and management. Row crops can be grown most of the time. Soybeans are difficult to grow and harvest because of weeds. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses help to maintain organic matter and good tilth and help reduce wind erosion.

This soil is suited to growing grasses for hay or pasture if adequate drainage is provided. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture in good condition.

This soil is poorly suited to growing trees for timber production. The water table at or near the surface is the main limiting factor. Equipment limitation, seedling mortality, and windthrow hazard are severe and are difficult to overcome. Water-tolerant shrubs and trees grow in the undrained Edwards muck.

This soil is generally not suitable for building sites because of ponding and the low strength of the organic material. Ponding, frost action, and low strength of material severely limit this soil for local roads. The organic material should be removed and suitable material used as fill to raise and strengthen the base. Lowering the water table by ditches helps reduce the potential for frost action. Ditches might need to be pumped. This soil is generally not suitable for septic tank absorption fields because ponding and slow permeability or very slow permeability are limitations.

This soil is in capability subclass IVw and woodland suitability subclass 4w.

EsA—Elston loam, 0 to 2 percent slopes. This nearly level soil is deep and well drained. It is on outwash plains. Individual areas are large and irregular in shape. They range from 5 to 600 acres but are dominantly about 200 acres.

In a typical profile the surface layer is black loam about 10 inches thick. The subsurface layer is black and very dark grayish brown loam about 9 inches thick. The subsoil is about 29 inches thick. The upper part is dark yellowish brown, friable sandy loam, and the lower part is dark yellowish brown, very friable loamy sand. The substratum is brown sand to a depth of 60 inches. In some areas the subsoil has clay loam horizons or is very strongly acid. In some areas slopes are more than 2 percent.

Included with this soil in mapping are some small areas of Bourbon soils on slightly lower parts of the landscape and Troxel soils, which are in depressions or potholes. These inclusions make up about 8 percent of the unit.

This Elston soil has moderate available water capacity and is moderately rapidly permeable in the solum and very rapidly permeable in the substratum. Surface runoff is slow. The surface layer is friable and has good tilth. It is high in organic matter content.

Most areas of this soil are used for growing cultivated crops. Some are used for hay and pasture.

This soil is suited to growing corn, soybeans, and small grain. Droughtiness is the major limitation in use and management. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Deep rooted legumes and drought-tolerant grasses are best suited to this soil. When this soil is used for pasture, the major concern of management is overgrazing, which reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, and timely deferment of grazing during dry periods help keep the pasture and soil in good condition.

This soil is not rated for timber production because trees are not native to these soils. If trees are planted, they are used for windbreaks.

This soil is suitable for dwellings, for local roads and streets, and for septic tank absorption fields.

This soil is in capability subclass IIs and is not assigned to a woodland suitability subclass.

EsB—Elston loam, 2 to 6 percent slopes. This gently sloping soil is deep and well drained. It is on outwash plains. Individual areas are usually elongated and often are around depressional areas. They range from 2 to 160 acres but dominantly are about 30 acres.

In a typical profile the surface layer is very dark gray loam about 9 inches thick. The subsurface layer is dark brown loam about 4 inches thick. The subsoil is about 35 inches thick. The upper part is dark brown, friable sandy loam, and the lower part is yellowish brown, very friable loamy sand. The substratum is yellowish brown and light yellowish brown sand to a depth of 60 inches. Thin strata of dark yellowish brown loamy sand are in the lower part. In some areas the subsoil has clay loam horizons or the subsoil is very strongly acid. In some areas slope is less than 2 percent or are more than 6 percent.

Included with this soil in mapping are some small areas of Troxel soils, which are in depressions or potholes. This inclusion makes up about 10 percent of the unit.

This Elston soil has moderate available water capacity and is moderately rapidly permeable in the solum and very rapidly permeable in the substratum. Surface runoff is medium. The surface layer is medium acid or strongly acid, unless it is limed. It is friable, has good tilth, and is high in organic matter content.

Most areas of this soil are used for cultivated crops. Some are used for hay and pasture.

This soil is suited to growing corn, soybeans, and small grain. Droughtiness and a hazard of erosion are the major limitations in use and management. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Deep rooted legumes and drought-tolerant grasses are best suited to this soil. When this soil is used for pasture, the major concern of management is overgrazing, which reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, and timely deferment of grazing during dry periods help keep the pasture and soil in good condition.

This soil is not rated for timber production because trees are not native to these soils. If trees are planted, they are used for windbreaks.

This soil is suitable for dwellings, for local roads and streets, and for septic tank absorption fields.

This soil is in capability subclass IIe but is not assigned to a woodland suitability subclass.

Fh—Fluvaquents, loamy. This deep soil is nearly level and somewhat poorly drained. It is on bottom land. This soil normally has a short, steep slope between it and adjacent, higher lying soils. It is frequently flooded for short periods of time. Individual areas are irregular in shape and range from 5 to 100 acres in size. They are dominantly about 25 acres.

In a typical area of Fluvaquents, loamy, the surface layer is dark gray or dark grayish brown loam, silt loam, sandy loam, or loamy sand. The underlying horizons have gray mottles and are stratified layers. The layers are brownish yellow, dark grayish brown, and grayish brown and include loam, sandy loam, loamy sand, sand, and sandy clay loam.

Included with this soil in mapping are small areas of Adrian, Cohoctah, Palms, and Suman soils. Also included are some areas of sandy soils and some areas of soils that do not have gray mottles in the upper 18 inches of the profile. These inclusions make up as much as 20 percent of some units.

The Fluvaquents have moderate available water capacity and are moderately permeable. Surface runoff is slow. A seasonal high water table is at a depth of 1 foot to 3 feet during winter and spring. The surface layer ranges from medium acid to neutral. It is friable, easily tilled, and moderate in organic matter content.

Some areas of this soil are used for cultivated crops. Some are used for hay and pasture or are in woodland.

This soil is generally not suited to growing corn, soybeans, and small grain. Wetness and flooding are limitations in use and management of this soil.

This soil is poorly suited to growing grasses and legumes for hay or pasture. When the soil is adequately drained and protected from flooding, yields can be greatly increased. When this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to growing trees, but only a few areas are in woodland. Plant competition is the main limitation. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Harvesting timber and replanting trees is often restricted to drier seasons of the year.

Flooding and wetness are severe limitations of this soil for building sites. The soil is generally not suitable for this use. It is severely limited for local roads by flooding and frost action. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help overcome these limitations. This soil is severely limited by flooding and wetness for septic tank absorption fields. It is generally not suitable for this use.

This soil is in capability subclass Vw but is not assigned to a woodland suitability subclass.

Gf—Gilford fine sandy loam. This nearly level soil is deep and very poorly drained. It is on broad, glacial outwash plains. It is frequently ponded by surface runoff from adjacent, higher lying parts of the landscape. Individual areas are large and irregular in shape. They range from 15 to 680 acres but are dominantly about 200 acres.

In a typical profile the surface layer is very dark gray fine sandy loam about 10 inches thick. The subsurface layer is very dark gray, mottled, friable sandy loam about 5 inches thick. The subsoil is dark gray, mottled, firm sandy loam about 21 inches thick. The substratum is pale brown, mottled sand to a depth of 60 inches. In some areas the solum is loamy fine sand or has a layer of sandy clay loam more than 10 inches thick. In some areas the surface layer is a mucky fine sandy loam. In other areas the subsoil is strongly acid. In some areas in the southern part of the county, this soil has iron concretions. The iron concretions do not affect tillage or crop yields.

Included with this soil in mapping are some small areas of Bourbon soils that are on slightly higher parts of the landscape. This inclusion makes up about 8 percent of the unit.

This Gilford soil has moderate available water capacity and is moderately rapidly permeable in the solum and rapidly permeable in the substratum. Surface runoff from cultivated areas is very slow, or this soil becomes ponded. This soil has a high water table that is above the surface or within a depth of 1 foot during a significant part of the year. The surface layer for most cultivated areas is slightly acid to neutral. It is friable and has good tilth. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. A few are used for pasture and woodland.

Most areas of this soil are drained by subsurface drains and open ditches. Wetness is the major limitation in use and management. The adequately drained areas of this soil are well suited to growing corn, soybeans, and small grain. This soil is suited to intensive row cropping. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

This soil is suited to growing grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because it has a high water table. When this soil is used for pasture, the major concern of managment is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to growing trees. Only a few areas are in woodland. The soil is severely limited for the use of equipment and by the hazards of plant competition, seedling mortality, and windthrow. Wetness restricts harvesting of trees to extremely dry seasons or periods when the ground is frozen. Species that are tolerant to wetness should be favored in stands. Some replanting of seedlings might be necessary. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites by ponding. An adequate drainage system is needed to remove excess water. Ponding and frost action severely limit this soil for local roads and streets. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help overcome these limitations. This soil is severely limited for septic tank absorption fields by ponding and poor filtering qualities. Seepage of effluent into ground water supplies could become a problem.

This soil is in capability subclass IIw and woodland suitability subclass 4w.

HaA—Hanna sandy loam, 0 to 3 percent slopes. This nearly level and gently sloping soil is deep and moderately well drained. It is on outwash plains. Individual areas are irregular in shape and range from 5 to 120 acres in size. They are dominantly about 50 acres.

In a typical profile the surface layer is dark grayish brown sandy loam about 6 inches thick. The subsurface layer is dark brown sandy loam about 3 inches thick. The subsoil is about 56 inches thick. The upper part is dark brown, friable sandy loam. The middle part, consecutively, is dark yellowish brown, friable loam; brown, mottled, friable loam; and mottled dark yellowish brown and light brownish gray, friable sandy loam. The lower part is mottled yellowish brown, gray, and grayish brown stratified loamy sand, sand, and sandy loam. The substratum is yellowish brown, mottled sand to a depth of 80 inches. In some areas the subsoil is sandy loam and loamy sand. In some areas the surface layer is darker.

Included with this soil in mapping are small areas of Gilford soils, which are in the depressional areas, and some areas of Tracy soils that are on slightly higher parts of the landscape. These inclusions make up about 5 to 12 percent of the unit.

This Hanna soil has moderate available water capacity. It is moderately permeable in the solum and rapidly permeable in the substratum. Surface runoff is slow. This soil has a seasonal water table at a depth of 3 to 6 feet during the spring. The surface layer is strongly acid, unless it is limed. It is friable and easily tilled. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture, and others are in woodland.

This soil is suited to growing corn, soybeans, and small grain. The moderate available water capacity and the acidity are the major limitations in use and management. A conservation cropping system can include row crops most of the time. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, and small grain help maintain and improve tilth and organic matter content.

This soil is suited to growing grasses and legumes for hay or pasture if it is adequately limed. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to growing trees. It is moderately limited by the hazard of plant competition. Seedlings survive and grow well when competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is suitable for dwellings without basements. It is moderately limited for dwellings with basements by wetness. Dwellings should be constructed without basements, and the soil should be artificially drained to lower the water table. Frost action severely limits this soil for local roads and streets. Drainage ditches along the roads lowers the water table, which helps reduce frost damage. The soil is severely limited for septic tank absorption fields by wetness and poor filtering qualities. An adequate drainage system can help lower the water table. Although the effluent is readily absorbed into the soil, pollution of ground water supplies can become a problem.

This soil is in capability class I and woodland suitability subclass 1o.

Hh—Histosols and Aquolls. These deep soils are nearly level and depressional and very poorly drained. They are very low lying on lake plains, outwash plains, till plains, and moraines. Individual areas are generally covered by shallow water most of the year. Some years, they are continually covered with water. They are usually small and range from 3 to 200 acres but are dominantly about 10 acres.

In a typical area of Histosols 16 to 60 inches of black, slightly decomposed or highly decomposed organic material is over sand, loamy material, or marl. In a typical area of Aquolls, a thin layer of black organic material about 8 to 12 inches thick is over loamy mineral material. There are also areas where mineral material has washed over the muck from higher, surrounding soils.

Included with these soils in mapping are small areas of deep water where there is no vegetation. This makes up about 3 to 5 percent of the unit.

Most of the Histosols and Aquolls are used as wildlife habitat. These areas are used as a nursery for numerous aquatic species. When adjacent to streams, northern pike spawns in these areas. The areas are also used by ducks, geese, and other birds for nesting, feeding, and protection.

These soils generally are not suitable for building sites and sanitary facilities because they are limited by ponding and moderately slow permeability. These limitations are extremely difficult to overcome because the areas are in the lowest lying part of the landscape and receive water from all adjacent slopes.

This soil is in capability subclass VIIIw but is not assigned to a woodland suitability subclass.

Hk—Homer loam. This nearly level soil is deep and somewhat poorly drained. It is on terraces, lake plains, and outwash plains. Individual areas are irregular in shape and range from 3 to 104 acres in size. They are dominantly about 20 acres.

In a typical profile the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is about 24 inches thick. The upper part is grayish brown and brown, mottled, firm clay loam, and the lower part is grayish brown, mottled, friable fine sandy loam. Between depths of 34 and 40 inches the substratum is mottled yellowish brown and grayish brown, stratified loamy sand and sand, and between 40 and 60 inches, it is yellowish brown sand. In some places the subsoil is not as thick. There are some small areas where the profile has more sand and others where the profile has more clay. In a few areas the surface layer is sandy, and the substratum is clay loam. There are a few areas where slope is more than 2 percent, and the soil does not have gray mottles above 18 inches.

Included with this soil in mapping are some small areas of Milford, Pewamo, and Riddles soils. These inclusions make up about 8 to 12 percent of the unit.

This Homer soil has moderate available water capacity and is moderately permeable in the solum and very rapidly permeable in the substratum. Surface runoff is slow. The soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring. The surface layer varies widely in reaction as a result of local liming practices. It is friable and easily tilled. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture, and some are in woodland.

This soil is suited to growing corn, soybeans, and small grain. Wetness is the main limitation in use and management. When the soil is adequately drained, a conservation cropping system can include row crops most of the time. Conservation tillage, using crop residue in and on the plow layer, and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

This soil is suited to growing grasses and legumes for hay or pasture. Draining this soil helps attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are not as well suited to this soil as shallow rooted legumes. When this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction and poor tilth. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to growing trees, but only a few areas are in woodland. Plant competition and the use of equipment are the main limitations when this soil is planted to trees. Seasonal wetness can cause a slight delay in harvesting or planting. Species that tolerate wet conditions should be favored in stands. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for dwellings by wetness. An adequate drainage system is needed to satisfactorily lower the water table. Dwellings should be constructed without basements. Frost action and low strength of soil material severely limit this soil for local roads and streets. The base material for roads needs strengthening with a suitable material to support vehicular traffic. Raising the base of the roadbed and providing adequate ditches and culverts help overcome ponding and frost damage. Wetness and poor filtering qualities are severe limitations of the soil for septic tank absorption fields. An adequate drainage system is needed to lower the water table. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies can become a problem.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

Hm—Houghton muck. This nearly level soil is deep and very poorly drained. It is in bogs within lake plains, outwash plains, till plains, and moraines. It is frequently ponded by surface runoff from adjacent, higher lying parts of the landscape. Individual areas are generally rounded or elongated. They range from 5 to 60 acres in size.

In a typical profile the surface layer is black muck about 9 inches thick. The underlying material is black, very dark brown, and very dark grayish brown, friable muck to a depth of about 70 inches. In some areas hemic material is throughout the profile. In a few areas the soil is more acid than normal or has gentle slopes.

Included with this soil in mapping are some small areas of Wallkill soils that make up about 5 to 8 percent of the unit.

This Houghton muck has very high available water capacity and is moderately slowly permeable to moderately rapidly permeable. Surface runoff ponds. This soil has a high water table that is at or above the surface during a considerable part of the year. The surface layer is generally slightly acid and is very high in organic matter content. The surface is a mat of decaying plants.

Most of this soil is used as wildlife habitat. This wetland is used as nursery areas for numerous aquatic species. It is used by ducks, geese, and other birds for nesting, feeding, and protection.

This soil is generally not suitable for building sites because of ponding and low strength of the organic material. Ponding, frost action, and low strength are severe limits of this soil for local roads and streets. The organic material should be removed and suitable material used as fill to raise and strengthen the base. The level of the roadway should be raised and adequate side ditches and culverts provided to help overcome the ponding and frost damage. This soil is generally not suitable for septic tank absorption fields because of ponding and moderately slow permeability.

This soil is in capability subclass Vw and woodland suitability subclass 4w.

Ho—Houghton muck, drained. This nearly level soil is deep and very poorly drained. It is in bogs within lake plains, outwash plains, till plains, and moraines. It is frequently ponded by surface runoff from adjacent higher lying parts of the landscape. All of this soil is artificially drained. Individual areas are generally rounded or elongated. They range from 5 to 80 acres in size.

In a typical profile the surface layer is black muck about 9 inches thick. The underlying organic material is black, very dark brown, and very dark grayish brown, friable muck to a depth of about 70 inches. In some areas hemic material is throughout the profile. In some areas the soil is more acid than normal, and in a few areas it has gentle slopes. In some areas the muck is underlain by sand, marl, or loamy material at a depth of less than 51 inches.

Included with this soil in mapping are some small areas of Martisco soils. This inclusion makes up less than 12 percent of the unit.

This Houghton muck has very high available water capacity and is moderately slowly permeable to moderately rapidly permeable. Surface runoff is very slow or ponds. This soil has a high water table that is at or above the surface for a considerable part of the year. The surface layer is generally slightly acid to medium acid. It is friable, has good tilth, and is very high in organic matter content.

Most areas of this soil are used for cultivated and specialty crops. Some areas are used for pasture.

This soil is suited to growing corn, soybeans, and specialty crops. Wetness and wind erosion are the major limitations in use and management. Row crops can be grown most of the time in adequately drained areas. Soybeans are difficult to grow and harvest because of weeds. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses help maintain organic matter and good tilth and help reduce wind erosion.

This soil is suited to growing grasses for hay or pasture. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture in good condition.

This soil is poorly suited to growing trees for wood production. The soil is severely limited for the use of equipment and by the hazards of plant competition, seedling mortality, and windthrow because the high water table is at or near the surface most of the year. These limitations are extremely difficult to overcome.

This soil is generally not suitable for building sites because of ponding and the low strength of the organic material. It is severely limited for local roads by ponding, frost action, and low strength of material. The organic material should be removed and suitable material used as fill to strengthen the base. The level of the roadway should be raised and adequate side ditches and culverts provided to overcome the ponding and frost damage. This soil generally is not suitable for septic tank absorption fields because of ponding and the moderately slow permeability.

This soil is in capability subclass IIIw and woodland suitability subclass 4w.

Md—Martisco muck, drained. This nearly level soil is deep and very poorly drained. It is in depressions of old lake beds, outwash plains, till plains and in isolated, backwater positions of flood plains. It is frequently ponded by surface runoff from adjacent, higher lying parts of the landscape. Nearly all of this soil is artificially drained. Individual areas are irregular in shape. They range from 5 to 160 acres in size but are dominantly about 15 acres.

In a typical profile the surface layer is black muck about 9 inches thick. The substratum is dark gray, grayish brown, and gray, friable marl to a depth of 60 inches. In some areas the muck surface layer is less than 8 inches thick or more than 16 inches thick.

This Martisco muck has very low available water capacity and is moderately permeable or moderately rapidly permeable in the organic material and slowly permeable in the marl and mineral substratum. Surface runoff is very slow or ponds. This soil has a high water table that is at or near the surface during a considerable part of the year. The surface layer is neutral to moderately alkaline. It is friable, has good tilth, and is very high in organic matter content.

Most areas of this soil are used for cultivated and specialty crops.

This soil is suited to growing corn, soybeans, and specialty crops. Wetness and wind erosion are the major limitations in use and management. A conservation cropping system that includes row crops most of the time can be used in adequately drained areas. Soybeans are difficult to grow and harvest because of weeds. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses help maintain organic matter and good tilth and help reduce wind erosion.

This soil is suited to growing grasses for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture in good condition.

This soil is poorly suited to growing trees for wood production. The water table at or near the surface is the main limiting factor. Equipment limitation, seedling mortality, and windthrow hazards are severe and are extremely difficult to overcome. Undrained areas are in water-tolerant shrubs and trees.

This soil generally is not suitable for building sites because of ponding and low strength of the organic material. Ponding, frost action, and low strength severely limit this soil for local roads. The organic matter and marl should be removed and suitable material used as fill to strengthen the base. Drainage ditches along the roads to lower the water table and elevating the base of the road helps overcome the frost damage. This soil is generally not suited to septic tank absorption fields because of ponding and slow permeability.

This soil is in capability subclass IVw and woodland suitability subclass 4w.

Mm—Maumee loamy fine sand. This nearly level soil is deep and very poorly drained. It is on outwash plains and lake plains. It is frequently ponded by surface runoff from adjacent, higher lying parts of the landscape. Nearly all of this soil is artificially drained. Individual areas are irregular in shape. They range from 5 to 300 acres in size but are dominantly about 135 acres.

In a typical profile the surface layer is black loamy fine sand about 10 inches thick. The subsurface layer is very dark gray loamy fine sand about 8 inches thick. Between depths of about 18 to 50 inches, the substratum is dark gray, mottled sand in the upper part and is light brownish gray, mottled sand in the lower part. To a depth of about 60 inches, the substratum is light brownish gray, mottled coarse sand. In some areas the surface layer is thinner and more acid. In some small areas the subsoil has more clay. In others shells are throughout the profile. In some areas this soil is brownish and has high concentrations of iron. In other areas the soil has only the concentrations of iron. Those areas where concentrations of iron are high are located in the southern part of the county. These high concentrations of iron do not affect tillage or crop yields.

Included with this soil in mapping are some small areas of Morocco soils. This inclusion makes up about 5 to 10 percent of the unit.

This Maumee soil has low available water capacity and is rapidly permeable. Surface runoff is very slow or ponds. This soil has a seasonal high water table that is above the surface or is within 1 foot during a significant part of the year. The surface layer is generally slightly acid or neutral. It is friable, has good tilth, and is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for growing small grain.

This soil is suited to growing corn, soybeans, and small grain. Wetness is the major limitation in use and management. Artificial drainage is needed for crop production; however, droughtiness is a problem in drained areas. A suitable controlled drainage system allows row crops to be included in a cropping system most of the time. Small grain is difficult to grow if the drainage system is inadequate because the high water table at or near the surface during the growing season injures or kills stands. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help maintain organic matter and good tilth.

This soil is suited to growing grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because of the high water table. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to growing trees, and only a few areas are in woodland. The soil is severely limited for the use of equipment. It is severely limited by the windthrow hazard because the water table is at or near the surface for long periods of time. Wetness restricts harvesting of trees to extremely dry seasons or periods when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited and is generally unsuitable for building sites because of ponding. An adequate drainage system is needed to remove excess water. Ponding severely limits this soil for local roads and streets. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts along the road help overcome the ponding. This soil is severely limited and is generally unsuitable for septic tank absorption fields because of ponding and poor filtering qualities.

This soil is in capability subclass IIIw and woodland suitability subclass 4w.

Mn—Maumee Variant loamy sand. This nearly level soil is deep and very poorly drained. It is in alluvial positions on outwash plains. It is frequently ponded by surface runoff from adjacent higher lying parts of the landscape and is subject to frequent flooding. Individual areas are irregular in shape and are generally around old oxbows of the old Kankakee River. They range from 15 to 90 acres in size but are dominantly about 30 acres.

In a typical profile the surface layer is very dark brown loamy sand about 8 inches thick. The subsurface layer is grayish brown, mottled sand and thin tongues of very dark gray sand about 4 inches thick. The upper part of the substratum is dark grayish brown and brown, mottled sand, and the middle part is brown, mottled sand that has a 2-inch band of black muck. Below this, to a depth of 60 inches, is mottled gray, yellowish brown, and reddish brown sand that has 1/8- to 1/4-inch bands of organic matter. The entire profile has many partially decomposed shells in it. In some small areas organic matter decreases regularly with depth. In some small areas the soil has grayish, mottled horizons, does not have shells throughout the profile, or has a thin surface layer of muck.

Included with this soil in mapping are small areas of Fluvaquents. This inclusion makes up about 8 to 10 percent of the unit.

This Maumee Variant has moderate available water capacity and is moderately rapidly permeable to very rapidly permeable. Surface runoff is very slow or ponds. This soil has a seasonal high water table that is above the surface or within 1 foot during a significant part of the year. The surface layer is generally neutral or mildly alkaline. It is friable, has good tilth, and is high in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for small grain.

This soil is suited to growing corn, soybeans, and small grain. Wetness and flooding are the major limitations in use and management. Droughtiness becomes a problem in drained areas. In adequately drained areas, a cropping system can include row crops most of the time. Small grain is difficult to grow if the drainage system is inadequate because the high water table at or near the surface during the growing season injures or kills stands. Conservation tillage, using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain help maintain organic matter and good tilth.

This soil is suited to growing grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage and pasture. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because of the high water table. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to growing trees, and only a few areas are in woodland. The soil is severely limited for the use of equipment. It is also severely limited by the hazards of seedling mortality and windthrow because the water table is at or near the surface for long periods of time. Wetness restricts harvesting of trees to extremely dry seasons or periods when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Some replanting of seedlings might be necessary. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is generally not suitable for building sites. Ponding and flooding are severe limitations for this use. Ponding, flooding, and frost action severely limit this soil for local roads. Drainage ditches along the roads to lower the water table help reduce the potential for frost action. Elevating the roadbed above the level of flooding or ponding also helps overcome these limitations. This soil is generally not suitable for septic tank absorption fields because of ponding, flooding, and poor filtering qualities.

This soil is in capability subclass IIIw and woodland suitability subclass 4w.

Mp—Milford silty clay loam. This nearly level soil is deep and poorly drained. It is on glacial lakebeds. It is occasionally ponded by surface runoff from adjacent higher lying parts of the landscape. Individual areas are broad and irregular in shape. They range from 10 to 200 acres in size but are dominantly about 50 acres.

In a typical profile the surface layer is black silty clay loam about 9 inches thick. The subsurface layer is very dark gray, mottled silty clay loam about 8 inches thick. The subsoil is gray, mottled, very firm silty clay loam about 21 inches thick. The upper part of the substratum, between 38 and 50 inches, is mottled gray and olive brown, stratified silty clay loam and sandy clay loam. Below this, to a depth of about 60 inches, the substratum is mottled olive brown, gray, and brown, stratified sandy loam, silt, and clay. In some areas the surface layer can be silt loam, and in some small areas the substratum is not stratified.

Included with this soil in mapping are a few small areas of soils that are on slightly higher parts of the landscape. These soils have a lighter colored surface layer and less clay in the upper horizons. This inclusion makes up about 8 to 12 percent of the unit.

This Milford soil has high available water capacity and is moderately slowly permeable. Surface runoff is very slow or ponds. This soil has a seasonal high water table that is above or within 2 feet of the surface during the spring. The surface layer is medium acid unless it is limed. It becomes cloddy and hard to work if tilled when too wet. It is high in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and some are in woodland.

This soil is well suited to growing corn, soybeans, and small grain. Wetness is the major limitation in use and management. A cropping system can include row crops most of the time. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

This soil is well suited to growing grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are not as well suited to this soil as shallow rooted legumes. When this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is too wet, which causes surface compaction and poor tilth. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is not rated for timber production because trees are not native to these soils. If trees are planted, they are used for windbreaks. Water-tolerant trees and shrubs grow in some undrained areas.

This soil is severely limited and is generally unsuitable for building sites because of ponding. Frost action, ponding, and low strength severely limit this soil for local roads. Drainage ditches along the roads to lower the water table and elevating the roadbed help reduce ponding and frost damage. Strengthening the base material with sand and gravel helps support traffic. Ponding and the moderately slow permeability severely limit this soil for septic tank absorption fields. As a result, the soil is generally unsuitable for this use.

This soil is in capability subclass IIw but is not assigned to a woodland suitability subclass.

MrB2—Morley silt loam, 2 to 6 percent slopes, eroded. This gently sloping soil is deep and well drained and moderately well drained. It is on uplands. Individual areas are irregular in shape. They range from 3 to 100 acres in size but are dominantly about 25 acres.

In a typical profile the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is firm silty clay loam about 26 inches thick. The upper part is yellowish brown, the middle part is dark yellowish brown and yellowish brown, and the lower part is yellowish brown and is mottled. The substratum is pale brown, mottled silty clay to a depth of 60 inches. In some areas the solum is more than 48 inches thick. In some places the soil has a surface layer of loam. In some places the soil has slope of more than 6 percent, and in a few it has slope of less than 2 percent.

Included with this soil in mapping are some small areas of Blount soils in lower positions of the landscape. This inclusion makes up about 10 to 15 percent of the unit.

This Morley soil has high available water capacity and is moderately slowly permeable. This soil has a water table that is at a depth of 3 to 6 feet. Surface runoff is rapid. This soil has a water table that is at a depth of 3 to 6 feet. The surface layer is medium acid to neutral. It becomes cloddy and hard to work if it is tilled when wet. It is moderate in organic matter content.

Some areas of this soil are used for cultivated crops. Some areas are in pasture, and some are in woodland. Some urban development has taken place on this soil in the northern part of the county.

This soil is well suited to growing corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Using crop residue in or on top of the plow layer and a cover of grasses, legumes, or small grain also help control erosion and improve and maintain tilth and organic matter content.

This soil is well suited to growing grasses and legumes for hay or pasture. These crops are also effective in controlling wind and water erosion. When this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. Plant competition is the main limitation. Seedlings survive and grow well when competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is moderately limited for dwellings without basements by shrinking and swelling of the soil. Wetness and shrink-swell potential are moderate limitations of this soil for dwellings with basements. Footings and foundations should be designed to prevent structural damage caused by shrinking and swelling of the soil. Houses should be constructed without basements, or foundation drains should be installed. Low strength severely limits this soil for local roads and streets. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps support vehicular traffic. This soil is severely limited for septic tank absorption fields by wetness and moderately slow permeability. Where commercial sewers are not available, absorption fields should be increased in size to overcome the reduced permeability of the subsoil.

This soil is in capability subclass IIe and woodland suitability subclass 2o.

MrC2—Morley silt loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is deep and well drained and moderately well drained. It is on uplands. Individual areas are irregular in shape. They range from 3 to 50 acres in size but are dominantly about 20 acres.

In a typical profile the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is firm silty clay loam about 26 inches thick. The upper part is yellowish brown, the middle part is dark yellowish brown and yellowish brown and is mottled, and the lower part is yellowish brown and is mottled. The substratum is pale brown, mottled silty clay loam to a depth of 60 inches. In some areas the solum is more than 48 inches thick. In some places the soil has slope of less than 6 percent and in a few it has slope of more than 12 percent. In some small areas the soil is severely eroded.

This Morley soil has high available water capacity and is moderately slowly permeable. Surface runoff is rapid. This soil has a water table that is at a depth of 3 to 6 feet. The surface layer is medium acid to neutral. It becomes cloddy and hard to work if it is tilled when wet. It is medium in organic matter content.

Some areas of this soil are used for cultivated crops. Some areas are in pasture, and others are in woodland. Some urban development has taken place on this soil in the northern part of the county.

This soil is poorly suited to growing cultivated crops. Erosion is a severe problem when growing corn and soybeans. Small grain can be grown in rotation with meadow or pasture. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain help control erosion and help improve and maintain tilth and organic matter content.

This soil is well suited to growing grasses and legumes for hay or pasture. These crops are also effective in controlling wind and water erosion. When this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. Plant competition is the main limitation. Seedlings survive and grow well when competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is moderately limited for dwellings with and without basements by slope and shrinking and swelling of the soil. Wetness is also a moderate limitation for dwellings with basements. Houses should be built without basements and designed to fit the moderate slopes. Extensive earth moving can be required to level the area sufficiently for construction. Footings and foundations should be designed to prevent structural damage caused by shrinking and swelling of the soil. If dwellings are to be constructed with basements, foundation drains should be installed. Developing one lot at a time while retaining as much existing vegetation as possible helps reduce soil erosion. Other measures to reduce erosion are: To design housing so roads follow the contour of the slope, to have diversions between lots to intercept runoff, and to stockpile topsoil and put it back as the final layer. The topsoil should be reseeded as quickly as possible to reduce the possibility of the topsoil eroding. This soil is severely limited for local roads and streets by low strength. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps support vehicular traffic. Moderately slow permeability and wetness severely limit this soil for septic tank absorption fields. Where commercial sewers are not available, increasing the size of absorption fields has been used to overcome the reduced permeability of the subsoil. Slopes can present problems in design. The number of lines might have to be reduced and then lengthened to obtain the desired size of field, or some lines might be placed at greater depths so all lines receive equal flow.

This soil is in capability subclass IIIe and woodland suitability subclass 2o.

MrD2—Morley silt loam, 12 to 18 percent slopes, eroded. This strongly sloping soil is deep and well drained and moderately well drained. It is on uplands. Individual areas are irregular in shape. They range from 3 to 30 acres in size.

In a typical profile the surface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 25 inches thick. The upper part is yellowish brown, firm loam; the middle part is dark yellowish brown and yellowish brown, firm clay loam; and the lower part is yellowish brown, mottled, firm clay loam. The substratum is pale brown, mottled clay loam to a depth of 60 inches. In places the surface layer is yellowish brown. In some areas the solum is more than 48 inches thick. In some places the soil has slope that is less than 12 percent or more than 18 percent. There are some small areas of severely eroded soils.

This Morley soil has high available water capacity and is moderately slowly permeable. Surface runoff is very rapid. This soil has a water table that is at depth of 3 to 6 feet. The surface layer is medium acid to neutral. It is friable and is moderate in organic matter content.

Most areas of this soil are in woodland. A few areas are in pasture or are used for cultivated crops.

This soil is poorly suited to growing cultivated crops. Erosion is severe if the soil is tilled. Because of the heavy textures and the slow permeability, surface runoff becomes a problem if crops are grown. Small grain can be grown in rotation with meadow or pasture. If cropping is attempted, conservation practices, such as crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures, are needed to help prevent excessive soil loss. The practices used will need to be based on the size of the unit of soil. Using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain also help control erosion and help improve and maintain tilth and organic matter content.

This soil is suited to growing grasses and legumes for hay or pasture. These crops help control wind and water erosion and reduce the velocity of surface runoff. When this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. The soil has moderate limitations for the use of equipment. Slopes are too steep to use some machinery. The soil is also limited moderately by seedling mortality, erosion, and plant competition. Tree seedlings should be planted as early as possible in the spring to reduce mortality. Some replanting of seedlings might be necessary. Seedling survival and growth is improved if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites by slope. Houses should be designed to fit the slope or extensive earthmoving is required. Footings and foundations should be designed to prevent structural damage caused by shrinking and swelling of the soil. Developing one lot at a time while retaining as much existing vegetation as possible helps reduce soil erosion. Other measures to reduce erosion are: Design housing so roads follow the contour of the slopes, have diversions between lots to intercept runoff, stockpile topsoil and put it back as the final layer, and reseed as quickly as possible to desired grasses to reduce the possibility of the topsoil eroding. This soil is severely limited for local roads and streets by slope and low strength. Extensive road cuts might be necessary. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps support vehicular traffic. Slope, wetness, and moderately slow permeability severely limit this soil for septic tank absorption fields. Where commercial sewers are not available, an alternate site should be selected for the septic tank absorption field. It is difficult to operate machinery on some of the slopes to install the absorption fields. Slope presents problems in design.

This soil is in capability subclass IVe and woodland suitability subclass 2r.

Mx—Morocco loamy fine sand. This nearly level soil is deep and somewhat poorly drained. It is on outwash plains. Individual areas are irregular to rounded in shape. They range from 3 to 542 acres in size but are dominantly about 50 acres.

In a typical profile the surface layer is very dark gray loamy fine sand about 6 inches thick. The subsurface layer is yellowish brown loamy fine sand about 8 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, mottled, friable loamy fine sand, and the lower part is pale brown and very pale brown, mottled, loose fine sand. Between depths of 47 and 57 inches, the substratum is brown, mottled sand, and between depths of 57 and 60 inches, it is pale brown sand. In some places the dark colored surface layer is more than 10 inches thick. There are some small areas where the soil has strata of loamy sand and sandy loam. Also there are small areas where the subsoil is lighter colored.

Included with this soil in mapping are some small areas of Maumee and Newton soils in the depressional areas. These inclusions make up about 5 to 18 percent of the unit.

This Morocco soil has low available water capacity and is rapidly permeable. Surface runoff is slow. This soil has a seasonal high water table that is at a depth of 1 foot to 2 feet during the winter and spring. The surface layer is strongly acid or very strongly acid unless it is limed. It is very friable, has good tilth, and is moderate in organic matter content.

Some areas of this soil are used for cultivated crops. Some areas are used for hay and pasture, and some are in woodland.

This soil is suited to growing corn, soybeans, and small grain. Wetness is the major limitation in use and management. Droughtiness becomes a problem in drained areas. Wind erosion can also occur during dry periods. When this soil is adequately drained, a cropping system can include row crops most of the time. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content and help control wind erosion.

This soil is suited to growing grasses and legumes for hay or pasture. Draining this soil helps attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because of the high water table. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing allows wind erosion and reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet and very dry periods help keep the pasture and soil in good condition.

This soil is suited to growing trees, but only a few areas are in woodland. It is limited moderately by seedling mortality. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites by wetness. An adequate drainage system is needed to satisfactorily lower the water table. Dwellings should be constructed without basements. Frost action and wetness moderately limit this soil for local roads and streets. Drainage ditches along the roads to lower the water table and elevating the roadbed help overcome wetness and frost damage. This soil is severely limited for septic tank absorption fields by wetness and poor filtering qualities. When urban sanitary facilities are not available, septic tank absorption fields can pollute nearby ground water supplies.

This soil is in capability subclass IVs and woodland suitability subclass 3o.

Mz—Muskego muck, drained. This nearly level or depressional soil is deep and very poorly drained. It is in bogs within the lake plains, outwash plains, till plains, and the moraine. It is frequently ponded by surface runoff from adjacent higher lying parts of the landscape. Individual areas are generally rounded or elongated. They range from 5 to 80 acres in size but are dominantly about 30 acres.

In a typical profile the surface layer is black muck about 10 inches thick. The subsurface layer is reddish brown, slightly decomposed muck about 6 inches thick. The underlying coprogenous earth extends to a depth of about 78 inches. The upper part is very dark gray, the middle part is dark brown, and the lower part is dark gray. Below this, to a depth of 80 inches, is gray marl. There are some small areas of soils that are underlain by marl or sandy or loamy material. Also there are areas of soils where the muck is more than 51 inches thick.

This Muskego muck has very high available water capacity and is moderately slowly permeable to moderately rapidly permeable in the upper part of the solum and slowly permeable in the underlying coprogenous earth. Surface runoff is very slow or ponds. This soil has a high water table that is at or above the surface a considerable part of the year. The surface layer is slightly acid or medium acid. It is friable, has good tilth, and is very high in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for pasture.

This soil is suited to growing corn, soybeans, and specialty crops. Wetness, ponding, and wind erosion are the major limitations in use and management. When this soil is adequately drained, a conservation crop system can include row crops most of the time. Soybeans are difficult to grow and harvest because of weeds. Conservation tillage, using crop residue in or on top of the soil, and a cover crop of grasses help maintain organic matter and tilth and help reduce wind erosion.

This soil is suited to growing grasses for hay or pasture. When the soil is adequately drained, yields can be greatly increased. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture in good condition.

This soil is poorly suited to growing trees for wood production. It is limited severely for the use of equipment. The soil is also limited severely by the hazards of plant competition, seedling mortality, and windthrow because the high water table is at or above the surface most of the year. Harvesting and logging should be done during drier seasons of the year or periods when the ground is frozen. Water-tolerant trees and shrubs are growing in the undrained areas.

This soil is generally not suitable for building sites because of the low strength of the organic material and ponding. Ponding, frost action, and low strength severely limit this soil for local roads. The organic material and the coprogenous earth should be removed and suitable material used as fill to strengthen the base. Lowering the water table by using side ditches and culverts and elevating the roadbed helps reduce ponding and frost damage. This soil is generally not suitable for septic tank absorption fields. Ponding and slow permeability in the coprogenous earth material are severe limitations for this use.

This soil is capability subclass IVw and woodland suitability subclass 4w.

Nf—Newton loamy fine sand. This nearly level soil is deep and very poorly drained. It is acid and is on outwash plains and lake plains. It is frequently ponded by surface runoff from adjacent higher lying parts of the landscape. Individual areas are rounded to oblong in shape. They range from 3 to 400 acres in size but are dominantly about 50 acres.

In a typical profile the surface layer is black loamy fine sand about 10 inches thick. The subsurface layer is very dark gray loamy fine sand about 5 inches thick. To a depth of 60 inches, the substratum, in sequence downward, is light brownish gray, mottled fine sand; light gray fine sand; gray, mottled fine sand; gray loamy fine sand; and gray fine sand. There are some small areas where the solum is less acid or where the subhorizons have more clay.

Included with this soil in mapping are some small areas of Saugatuck and Morocco soils. These inclusions make up about 3 to 8 percent of the unit.

This Newton soil has low available water capacity and is rapidly permeable. Surface runoff is very slow or ponds. This soil has a seasonal high water table that is above the surface or within 1 foot of the surface during a significant part of the year. The surface layer is strongly acid, unless it is limed. It is moderate in organic matter content.

Most areas of this soil in the southern part of the county are used for cultivated crops. Some areas are used for pasture and some for woodland.

This soil is suited to growing corn, soybeans, and small grain. The seasonal high water table and strong acidity are the major limitations that affect the use and management of this soil. Droughtiness can become a problem in drained areas. A suitable drainage system is difficult to establish because adequate outlets are not available in most places. Excessive drainage can cause droughtiness and wind erosion. If a suitable controlled drainage system is established, a conservation cropping system can include row crops most of the time. Small grain is difficult to grow if the drainage system is inadequate because the high water table at or near the surface during the growing season injures or kills stands. Lime should be added according to soil tests and plant needs for crop growth and production. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

This soil is suited to growing grasses and legumes for hay or pasture. When the soil is adequately drained, yields can be greatly increased. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because of the high water table. When this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet. Artificial drainage is needed to remove excess water. Overgrazing can allow wind erosion and reduce the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to trees. Some water-tolerant trees grow on this soil. This soil is severely limited for the use of equipment. It is also limited severely by the hazards of seedling mortality, windthrow, and plant competition because the water table is at or near the surface of the soil for extended periods. Wetness restricts harvesting of trees to extremely dry seasons or periods when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Some replanting of seedlings might be necessary. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited and is generally unsuitable for building sites because of ponding. Most areas of this soil are difficult to drain because they are often in the lowest lying part of the landscape and receive surface runoff from adjacent slopes. Ponding severely limits this soil for local roads and streets. Drainage ditches along the roads to lower the water table or elevating the roadbed above the ponding level helps overcome this limitation. This soil is severely limited and is generally unsuitable for septic tank absorption fields by ponding and poor filtering qualities.

This soil is in capability subclass IVw and woodland suitability subclass 4w.

OaC—Oakville fine sand, 4 to 12 percent slopes. This gently sloping and moderately sloping soil is deep and well drained. It is on outwash plains, low sand dunes, and beach ridges. Individual areas are irregular in shape. They range from 5 to 110 acres in size but are dominantly about 35 acres.

In a typical profile the surface layer is dark yellowish brown fine sand about 8 inches thick. The subsoil is about 25 inches thick. The upper part is yellowish brown, loose fine sand, and the lower part is brownish yellow, loose fine sand. The substratum is very pale brown fine sand. In some areas the surface layer is less than 8 inches thick. In some places the soil has slope of less than 4 percent or more than 12 percent. In some places the soil is strongly acid.

Included with this soil in mapping are some areas of moderately well drained Brems soils in slightly lower positions, somewhat poorly drained Morocco soils on lower lying flats, and very poorly drained Newton soils in low lying swales and poorly defined drainageways. These inclusions make up about 5 to 10 percent of the unit.

This Oakville soil has low available water capacity and is very rapidly permeable. Surface runoff is medium or slow. The surface layer is neutral. It is moderate in organic matter content.

Most areas of this soil are in woodland. The trees have stabilized the movement of the sand.

Trees grow fairly well on this soil. Seedling mortality caused by the droughtiness of this soil is a severe limitation when this soil is planted to trees. Tree seedlings should be planted as early as possible in the spring. Some replanting of seedlings is usually needed to maintain density of stands. Seedlings survive and grow fairly well when competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is moderately limited for dwellings with and without basements by slope. Some earthmoving might be required to build. Foundations and footings should be constructed to provide stability of the structure. Banks slough in most excavations. Slope moderately limits this soil for local roads and streets. Poor filtering qualities severely limit this soil for septic tank absorption fields. Septic tank absorption fields can seep and pollute nearby shallow wells.

This soil is in capability subclass VIs and woodland suitability subclass 3s.

OaE—Oakville fine sand, 12 to 25 percent slopes. This strongly sloping to moderately steep soil is deep and well drained. It is on outwash plains, low sand dunes, and beach ridges. Individual areas are irregular in shape. They range from 5 to 150 acres in size but are dominantly about 45 acres.

In a typical profile the surface layer is black fine sand about 4 inches thick. The subsurface layer is dark grayish brown fine sand about 10 inches thick. The subsoil is yellowish brown, loose fine sand about 25 inches thick. The substratum is light yellowish brown fine sand to a depth of about 60 inches. In some areas the dark colored surface layer is less than 4 inches thick. In some areas the substratum is very pale brown. In some places the soil is strongly acid. In others it has slope of less than 12 percent or more than 25 percent.

Included with this soil in mapping are some areas of Duneland that also is strongly sloping to moderately steep. This inclusion makes up about 3 to 5 percent of the unit.

This Oakville soil has low available water capacity and is very rapidly permeable. The organic matter content of the surface layer is moderate. Surface runoff is medium or rapid. The surface layer is neutral. It is moderate in organic matter content.

Most areas of this soil are in woodland. The trees have stabilized the movement of sand.

Trees grow fairly well on this soil. The soil is severely limited for the use of equipment. Seedling mortality caused by the droughtiness on the sandy slopes is a severe limitation when this soil is planted to trees. Erosion is a moderate limitation for trees planted on this soil. Tree seedlings should be planted as early as possible in the spring to take advantage of moisture available. Some replanting of seedlings is usually needed to maintain density of stands. Seedling survival and growth is improved if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites by slope. Extensive earthmoving might be required to build. Houses need to be of special design to fit these sites. Foundations and footings should be constructed to provide stability of the structure. Structures might need to be placed on pilings. Banks slough in most excavations. Slope severely limits this soil for local roads and streets. Extensive road cuts might be necessary, and roads should be placed on the contour of the slope to help reduce erosion. Slope and poor filtering qualities are severe limitations for septic tank absorption fields. Septic tank absorption fields can seep and pollute nearby shallow wells. If commercial sewers are not available, an alternate site should be selected for the filter field.

This soil is in capability subclass VIIs and woodland suitability subclass 3s.

Pa—Palms muck, sandy substratum. This nearly level soil is deep and very poorly drained. It is on lake plains, till plains, or moraines that are in basins that were lakes or ponds. It is frequently ponded with surface runoff from adjacent higher lying parts of the landscape. Individual areas are generally rounded or elongated. They range from 3 to 490 acres in size but are dominantly about 20 acres.

In a typical profile the surface layer is black muck about 10 inches thick. The underlying muck is black and extends to a depth of about 24 inches. Between depths of 24 and 44 inches, the upper part of the substratum is dark grayish brown and dark gray and grayish brown, mottled loam. Between depths of 44 and 54 inches, the substratum is dark grayish brown and grayish brown, mottled sandy loam. To a depth of 60 inches it is gray sand. In some areas the substratum is loam to a depth of more than 60 inches. There are a few small areas where the muck surface is less than 16 inches thick. In some areas the muck is more than 51 inches thick. In some areas the organic horizon is slightly acid or neutral. There are some areas where the muck is underlain by sandy material, marl, or coprogenous earth.

Included with this soil in mapping are some small areas of Wallkill soils. This inclusion makes up about 5 to 15 percent of the unit.

This Palms muck has very high available water capacity. It is moderately slowly permeable to moderately rapidly permeable in the organic layers and moderately permeable to moderately slowly permeable in the loamy substratum. Surface runoff is very slow or ponds. This soil has a seasonal high water table that is at or above the surface much of the year. The surface layer is slightly acid or medium acid. It is friable, has good tilth, and is very high in organic matter content.

Most areas of this soil are used for cultivated crops and some specialty crops. Some areas are used for pasture or are in woodland.

This soil is suited to growing corn, soybeans, and specialty crops. Wetness and wind erosion are the major limitations in use and management of this soil. A conservation cropping system can include row crops most of the time. Soybeans are difficult to grow and harvest because of weeds. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses help control wind erosion and help maintain tilth and organic matter content.

This soil is suited to growing grasses for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to growing trees for wood production. The water table at or near the surface is the main limiting factor. Equipment limitation, seedling mortality, and windthrow hazards are severe and are extremely difficult to overcome.

This soil is generally not suitable for building sites because of the low strength of the organic material and ponding. Ponding, frost action, and low strength severely limit this soil for local roads. The muck should be removed and suitable material used as fill to strengthen the base. Lowering the water table by using side ditches along roads and culverts and elevating the roadbed help overcome ponding and frost damage. This soil is generally not suitable for septic tank absorption fields because of ponding and the moderately slow permeability.

This soil is in capability subclass IIIw and woodland suitability subclass 4w.

Pe—Pewamo silty clay loam. This nearly level soil is deep and very poorly drained. It is in depressional areas of till plains, lake plains, and moraines. It is frequently ponded by surface runoff from adjacent higher lying parts of the landscape. Individual areas are irregular or elongated in shape. They follow drainageways or are in depressions. They range from 3 to 84 acres in size but are dominantly about 10 acres.

In a typical profile the surface layer is black silty clay loam about 10 inches thick. The subsoil is about 29 inches thick. It is dark gray, mottled, firm silty clay loam in the upper part and grayish brown, mottled clay loam and silty clay loam in the lower part. The substratum is grayish brown, mottled silty clay loam to a depth of 60 inches. In some places the dark surface layer is the depth of the plow layer. In some places thin layers of overwash material from surrounding soils cover the surface.

Included with this soil in mapping are a few small areas of Blount and Homer soils on slightly higher parts of the landscape and Washtenaw soils in slightly lower parts or in depressional areas. These inclusions make up about 8 to 12 percent of the unit.

This Pewamo soil has high available water capacity and is moderately slowly permeable. Surface runoff is very slow or ponds. This soil has a seasonal high water table that is above or within 1 foot of the surface in the early spring. The surface layer is slightly acid or neutral. It is firm and becomes cloddy and hard to work if tilled when wet. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to growing corn, soybeans, and some small grain. It is poorly suited to winter wheat because ponding usually destroys stands. Wetness is the main limitation that affects the use and management of this soil. Excessive water can be removed by open ditches, subsurface drains, surface drains, pumping, or a combination of these practices. Where drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage and using crop residue in or on top of the plow layer help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are not as well suited to this soil as shallow rooted legumes. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to growing trees. It is severely limited for the use of equipment. Seedling mortality, windthrow, and plant competition are moderate limitations because the seasonal high water table is at or near the surface for long periods of time. Wetness restricts harvesting trees to dry seasons or periods when the ground is frozen. Some replanting of seedlings is needed to maintain density of stands. Species which are tolerant to wetness should be favored in stands. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited and is generally unsuitable for building sites because of ponding. It is difficult to drain most areas of this soil because it is often in the lowest lying parts of the landscape and receives surface runoff from adjacent slopes. Ponding, low strength, and frost action severely limit this soil for local roads. The base material for roads should be removed and replaced with a suitable material to support vehicular traffic. Raising the base of the roadbed and providing adequate side ditches along roads and culverts helps overcome ponding and frost damage. This soil is severely limited and is generally unsuitable for septic tank absorption fields because of ponding and moderately slow permeability.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

Ph—Pinhook loam. This nearly level soil is deep and poorly drained. It is on broad flats of outwash plains. Individual areas are broad and irregular in shape. They range from 2 to 42 acres in size but are dominantly about 15 acres.

In a typical profile the surface layer is very dark gray loam about 8 inches thick. The subsurface layer is gray, mottled loam about 4 inches thick. The subsoil is about 39 inches thick. The upper part is gray, mottled, firm loam; the middle part is gray, mottled, friable and very friable sandy loam; and the lower part is strong brown and gray, very friable, stratified shaly sandy loam and loamy sand. The substratum is mottled gray and yellowish brown, stratified loamy sand and sand to a depth of 60 inches. In some places the solum is less than 40 inches thick. In some places the surface layer is thicker or is lighter colored.

Included with this soil in mapping are a few small areas of Bourbon soils on slightly higher parts of the landscape. This inclusion makes up less than 8 percent of the unit.

This Pinhook soil has moderate available water capacity and is moderately rapidly permeable in the solum and rapidly permeable in the substratum. Surface runoff is slow. This soil has a seasonal high water table that ranges from the surface to a depth of 1 foot during the winter and spring. The surface layer is strongly acid unless it is limed. It is friable, but tillage is limited to periods when the water table is low. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few are in woodland.

This soil is well suited to growing corn, soybeans, and small grain. Wetness is the main limitation that affects the use and management of this soil. Excessive water can be removed by open ditches, subsurface drains, pumping, or a combination of these practices. Where drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage and using crop residue in or on the plow layer help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because of the seasonal high water table. When this soil is used for pasture, the main concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to growing trees. It is severely limited for the use of equipment. It is also limited severely by plant competition and moderately limited by windthrow and seedling mortality. Seasonal wetness can cause a slight delay in harvesting or planting. Species which are tolerant to wetness should be favored in stands. Some replanting of seedlings might be needed to maintain density of stands. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites by wetness. An adequate drainage system is needed to satisfactorily lower the water table. Dwellings should be constructed without basements. Wetness and frost action severely limit this soil for local roads and streets. Drainage ditches along the roads to lower the water table and elevating the roadbed helps overcome wetness and frost action. This soil is severely limited for septic tank absorption fields by wetness and poor filtering qualities. When sanitary facilities are not available, septic tank absorption fields can pollute nearby shallow wells.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

Qu—Quinn loam. This nearly level soil is deep and poorly drained. It is on broad flats of outwash plains. Individual areas are irregular in shape. They range from 3 to 40 acres in size.

In a typical profile the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is light brownish gray, mottled, friable loam; the middle part is grayish brown and gray, mottled, firm loam and sandy loam; and the lower part is grayish brown, mottled, very friable loamy sand. The substratum is light brownish gray sand to a depth of 60 inches. In some places the solum is less than 40 inches thick. In some places the surface layer is lighter colored.

Included with this soil in mapping are a few small areas of dark Bourbon soils on slightly higher parts of the landscape. This inclusion makes up less than 8 percent of the unit.

This Quinn soil has moderate available water capacity. It is moderately permeable in the upper part of the solum and is rapidly permeable in the lower part of the solum and in the substratum. Surface runoff is slow. This soil has a seasonal high water table that ranges from the surface to a depth of 1 foot during the winter and spring. The surface layer is very strongly acid, unless it is limed. It is friable, but tillage is limited to periods when the water table is low. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few are in woodland.

This soil is well suited to growing corn, soybeans, and small grain. Wetness is the main limitation that affects the use and management of this soil. Excessive water can be removed by open ditches, subsurface drains, pumping, or a combination of these practices. Where drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage and using crop residue in or on top of the plow layer help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Draining this soil is necessary to obtain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because of the seasonal high water table. When this soil is used for pasture, the main concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to growing trees. It is severely limited for the use of equipment and by the hazards of plant competition, windthrow, and seedling mortality. Seasonal wetness can cause a slight delay in harvesting or planting. Species that tolerate wet conditions should be favored in stands. Some replanting of seedlings might be needed to maintain density of the stand. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites by wetness. An adequate drainage system is needed to satisfactorily lower the water table. Dwellings should be constructed without basements. Wetness and frost action severely limit this soil for local roads and streets. Drainage ditches along the roads to lower the water table and elevating the roadbed help overcome the wetness and frost action. This soil is severely limited for septic tank absorption fields by wetness and poor filtering qualities. When sanitary facilities are not available, septic tank absorption fields can pollute nearby shallow wells.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

RIA—Riddles loam, 0 to 2 percent slopes. This nearly level soil is deep and well drained. It is on uplands. Individual areas are small and irregular in shape. They range from 3 to 35 acres in size.

In a typical profile the surface layer is dark grayish brown loam about 9 inches thick. The subsoil is dark yellowish brown or brown, firm loam and clay loam about 40 inches thick. The substratum is brown, mottled clay loam to a depth of 60 inches. In some places the solum is less than 40 inches thick. There are small areas where the substratum is 15 percent or more shale and gravel. In a few places the soil is underlain by sand or sandy loam or has slope of more than 2 percent.

Included with this soil in mapping are a few small areas of heavier textured Blount soils, sandier Tracy soils, and Homer soils on slightly lower parts of the landscape. These included soils make up about 2 to 8 percent of the unit.

This Riddles soil has high available water capacity and is moderately permeable. Surface runoff is slow. The surface layer is medium acid or strongly acid, unless it is limed. It is friable and easily tilled through a fairly wide range in moisture content. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few are in woodland or in orchards.

This soil is well suited to growing corn, soybeans, and small grain. Conservation tillage, using crop residue in or on top of the plow layer, and a cover crop of grasses, legumes, or small grain help maintain and improve tilth and organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. When this soil is used for pasture, the major concerns of management are overgrazing or grazing when the soil is too wet, which causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. This soil is moderately limited by plant competition. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is moderately limited for building sites by shrink-swell. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling of the soil. Low strength and frost action moderately limit this soil for local roads. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic and to reduce frost damage. This soil is moderately limited for septic tank absorption fields by moderate permeability. Increasing the size of the septic tank absorption field can help overcome this problem.

This soil is in capability class I and woodland suitability subclass 1o.

RIB2—Riddles loam, 2 to 6 percent slopes, eroded. This gently sloping soil is deep and well drained. It is on broad, convex ridgetops and long side slopes of uplands. Individual areas are usually broad and irregular in shape. They range from 10 to 220 acres in size but are dominantly about 60 acres.

In a typical profile the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 39 inches thick. The upper part is brown, firm loam; the middle part is yellowish brown, firm clay loam; and the lower part is dark brown, friable sandy clay loam. The substratum is strong brown loam to a depth of 60 inches. In a few areas the surface layer is loamy sand, which can be as much as 15 inches thick. In some places the solum is less than 40 inches thick. There are small areas where the substratum is 15 percent or more shale and gravel. In a few areas the soil is silt loam or is underlain with sand. Also in a few areas the soil is clayey. There are some small areas of eroded soil where the subsoil has been mixed into the surface soil by plowing and the surface layer is clay loam. In a few places the soil has slope of less than 2 percent or more than 6 percent.

Included with this soil in mapping are a few small areas of Chelsea and Tracy soils and a few small areas of Homer soils that are in flatter, low lying parts of the landscape. These inclusions make up about 8 to 12 percent of the unit.

This Riddles soil has high available water capacity and is moderately permeable. Surface runoff from cultivated areas is rapid. Unless it is limed, the surface layer is medium acid or strongly acid. It is friable and easily tilled through a fairly wide range in moisture content. It is low in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few are in orchards.

This soil is well suited to growing corn, soybeans, and small grain. Conservation practices are needed to help control erosion and surface runoff when cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help prevent excessive soil loss. Using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

The use of this soil for grasses and legumes for hay or pasture is effective in controlling wind and water erosion. When this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. The soil is moderately limited by the hazard of plant competition. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is moderately limited for dwellings by shrinking and swelling of the soil. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling of the soil. Some earthmoving might be required at some building sites. Low strength and frost action moderately limit this soil for local roads and streets. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic and reduce frost damage. This soil is moderately limited for septic tank absorption fields by moderate permeability. Increasing the size of the septic tank absorption field can help overcome this problem.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

RIC2—Riddles loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is deep and well drained. It is on broad convex ridgetops, on side slopes, and along drainageways of the uplands. Individual areas are irregular in shape. They range from 3 to 180 acres in size but are dominantly about 20 acres.

In a typical profile the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is dark yellowish brown and brown, firm loam and clay loam about 46 inches thick. The substratum is yellowish brown, mottled sandy clay loam and sandy loam to a depth of 60 inches. In some places the solum is less than 40 inches thick. In a few areas the surface layer is loamy sand, which can be as much as 15 inches thick. There are small areas where the substratum is 15 percent or more shale and gravel. In a few areas the soil is silt loam or clayey or is underlain by sand. Also there are small areas of more steeply sloping soil where the subsoil has been mixed into the surface soil by plowing, so that the surface layer is clay loam. In some areas stones or boulders are on the surface. The stones are from 3 to 12 inches in diameter and the boulders are up to 5 or 6 feet in diameter. In a few areas the soil has slope of less than 6 percent or more than 12 percent.

Included with this soil in mapping are a few small areas of moderately sloping Chelsea and Tracy soils. These inclusions make up about 5 to 12 percent of the unit.

This Riddles soil has high available water capacity and is moderately permeable. Surface runoff where this soil is cultivated is rapid. The surface layer is medium acid or strongly acid, unless it is limed. The surface layer is friable and easily tilled through a fairly wide range of moisture content. It is low in organic matter content.

Some areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few are in woodland or orchards.

This soil is suited to growing corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help prevent excessive soil loss. Using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

The use of this soil for grasses and legumes for hay or pasture is effective in controlling wind and water erosion. When this soil is used for pasture, the major concerns of management are overgrazing or grazing when the soil is wet, which causes surface compaction, excessive runoff, and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. This soil is limited moderately by plant competition. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is moderately limited for dwellings by slope and shrink-swell. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling of the soil. Earth moving might be required on building sites. Developing one lot at a time while retaining as much existing vegetation as possible helps reduce soil erosion. Other measures to reduce erosion are: Designing housing so that roads are on the contour of the slope, have diversions between lots to intercept runoff, and stockpiling topsoil and replacing it. The topsoil should then be reseeded as quickly as possible to desired grasses to reduce the possibility of erosion. Low strength, slope, and frost action moderately limit this soil for local roads and streets. Constructing roads on raised, well compacted fill material and providing adequate side ditches along roads and culverts help support vehicular traffic and reduce frost damage. Cuts and fills are needed, and roads should be built on the contour of the slope where possible. This soil is moderately limited for septic tank absorption fields by moderate permeability and slope. Increasing the size of the septic tank absorption field can help overcome the problem of moderate permeability. Land shaping and installing the distribution lines across the slope are generally necessary for proper functioning of the absorption field.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

RID2—Riddles loam, 12 to 18 percent slopes, eroded. This strongly sloping soil is deep and well drained. It is on ridgetops, side slopes, and along drainageways of uplands. Individual areas are irregular in shape. They range from 5 to 47 acres in size.

In a typical profile the surface layer is made up of yellowish brown loam and some soil material from the subsoil. It is about 8 inches thick. The subsoil is about 41 inches thick. The upper part is dark yellowish brown, firm loam, and the lower part is yellowish brown, firm clay loam. The substratum is brown loam to a depth of 60 inches. In some places the solum is less than 40 inches thick. In some areas the soil is clayey. There are small areas where the substratum is 15 percent or more shale and gravel. There are some small areas where the soil has been eroded and the subsoil has been mixed into the surface soil by plowing. In these areas the surface layer is clay loam. In some areas stones or boulders are on the surface. The stones are from 3 to 12 inches in diameter and the boulders are up to 5 or 6 feet in diameter. In a few areas the soil has slope of less than 12 percent or more than 18 percent.

Included with this soil in mapping are a few small areas of strongly sloping Chelsea and Tracy soils. These inclusions make up about 5 to 10 percent of the unit.

This Riddles soil has high available water capacity and is moderately permeable. Surface runoff from cultivated areas is very rapid. The surface layer is medium acid or strongly acid, unless it is limed. It is friable but low in organic matter content.

Most areas of this soil are used for orchards or woodland. Some areas are used for cultivated crops, and some are used for hay or pasture.

This soil is poorly suited to growing corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help prevent excessive soil loss. These practices need to fit both the size of the delineated area and the practices in use on the surrounding soils that are being farmed. Using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

The use of this soil for grasses and legumes for hay or pasture is effective in controlling wind and water erosion. When this soil is used for pasture the major concerns of management are overgrazing or grazing when the soil is too wet, which causes surface compaction, excessive runoff, and poor tilth. Overgrazing allows erosion and also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. Plant competition is the main limitation when this soil is planted to trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites by slope. Extensive earthmoving might be required at building sites. Developing one lot at a time while retaining as much existing vegetation as possible helps reduce soil erosion. Other measures to reduce erosion are: Designing housing so the roads follow the contour of the slope, have diversions between lots to intercept runoff, and stockpiling topsoil and returning it. The topsoil should be reseeded as quickly as possible to desired grasses to reduce the possibility of erosion. Slope severely limits this soil for local roads and streets. Cuts and fills are needed, and roads should be built on the contour where possible. This soil is severely limited for septic tank absorption fields by slope. Land shaping and installing the distribution lines across the contour generally is necessary for proper functioning of the absorption field.

This soil is in capability subclass IVe and woodland suitability subclass 1o.

RIF—Riddles loam, 25 to 45 percent slopes. This steep and very steep soil is deep and well drained. It is on side slopes, on ridgetops, and along drainageways of uplands. Individual areas are generally elongated in shape. They range from 10 to 80 acres in size but are dominantly about 15 acres.

In a typical profile the surface layer is brown loam about 3 inches thick. The subsoil is dark yellowish brown and brown, firm clay loam about 46 inches thick. The substratum is yellowish brown sand over dark yellowish brown, calcareous loam to a depth of 60 inches. In some places the solum is less than 40 inches thick. In some small areas the soil has more sand throughout the profile. Also, there are some small areas where the soil is clay loam throughout or where the substratum is 15 percent or more shale and gravel. In some areas stones or boulders are on the surface. The stones are from 3 to 12 inches in diameter and the boulders are up to 5 or 6 feet in diameter. In some places the soil has slope of less than 25 percent, and in a few places it has slope of more than 45 percent.

Included with this soil in mapping are some small areas of Tracy soils. This inclusion makes up about 3 to 5 percent of the unit.

This Riddles soil has high available water capacity and is moderately permeable. Surface runoff is very rapid. The surface layer is medium acid or slightly acid. It is friable but is low in organic matter content.

Most areas of this soil are in woodland that has been left to prevent erosion. A few areas are in grasses.

This soil is suited to growing trees. Plant competition is the main limitation when this soil is planted to trees. The soil is limited slightly for the use of equipment and by the hazard of erosion. These limitations are caused by slope. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited and is generally unsuitable for building sites and septic tank absorption fields because of slope. Slope severely limits this soil for local roads and streets. Extensive road cuts and filling are required. Roads should be built on the contour of the slope where possible.

This soil is in capability subclass VIe and woodland suitability subclass 1o.

Sa—Saugatuck-Pipestone complex. This nearly level, deep soil is poorly drained and somewhat poorly drained. Individual areas are on lake plains and outwash plains. They are 60 percent Saugatuck soils and 30 percent Pipestone soils. They are irregular in shape. They range from 3 to 80 acres in size but are dominantly about 20 acres.

In a typical profile of Saugatuck soils, the surface layer is black loamy fine sand about 4 inches thick. The subsurface layer is grayish brown fine sand about 6 inches thick. The subsoil is about 20 inches thick. The upper part is dusky red, weakly cemented fine sand; the middle part is dark reddish brown, strongly cemented fine sand; and the lower part is light yellowish brown, loose fine sand. The substratum is light yellowish brown and brown fine sand to a depth of 60 inches.

In a typical profile of Pipestone soils, the surface layer is black loamy fine sand about 9 inches thick. The subsurface layer is brown very fine sand about 6 inches thick. The subsoil is about 17 inches thick. The upper part is reddish brown, mottled, loose fine sand, and the lower part is strong brown, mottled, loose fine sand. The substratum is light yellowish brown, mottled fine sand to a depth of 60 inches. In some areas the surface layer is very dark gray.

Included with these soils in mapping are a few small areas of Newton and Morocco soils. These inclusions make up about 10 percent of the unit.

These Saugatuck and Pipestone soils have low available water capacity. The Saugatuck soil is slowly permeable in the ortstein layer and is rapidly permeable in the substratum. The Pipestone soil is rapidly permeable in the solum and very rapidly permeable in the substratum. Surface runoff is very slow or slow for the soils, or it can pond on the Saugatuck soil. The water table ranges from above the surface on both soils to within 2 feet of the surface in the Saugatuck soil and within 1.5 feet of the surface in the Pipestone soil. The surface layer is generally strongly or very strongly acid in the Saugatuck soil and medium acid in the Pipestone soil, unless it is limed. The surface layer of both soils is very friable and easily tilled. It is high in organic matter content in the Saugatuck soil and medium in the Pipestone soil.

Most areas of this unit are in woodland. Some areas are in cultivated crops, and a few are in grasses. Some building has taken place on this unit near Michigan City.

These soils are suited to growing corn, small grain, and some specialty crops. Wetness, the acid condition, and the ortstein layer in the Saugatuck soil are the major limitations in use and management of these soils. Excessive water can be removed by open ditches and surface drains. Liming can help overcome the acid condition of these soils. Conservation tillage and using crop residue in or on top of the plow layer help improve and maintain tilth and organic matter content.

These soils are suited to grasses for hay or pasture. Draining these soils helps attain high yields for forage or pasture. Most legumes do not grow well because of the wet condition and the strongly acid condition. When these soils are used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soils in good condition.

These soils are suited to growing trees, and most areas are in trees. The Saugatuck soil is severely limited for the use of equipment, but the Pipestone soil is only slightly limited. Plant competition and seedling mortality are severe limitations in the Saugatuck soil. Seedling mortality is a moderate limitation in the Pipestone soil. Windthrow hazard is a moderate limitation in the Saugatuck soil and a slight limitation in the Pipestone soil. The water table is at or near the surface much of the year. The ortstein layer of the Saugatuck soil restricts rooting depth. Seasonal wetness can cause a slight delay in harvesting or planting. Species that can tolerate wet conditions should be favored in stands. Some replanting of seedlings might be necessary to maintain density of stands. Growth and survival of seedlings are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This unit is severely limited and is generally unsuitable for building sites because of ponding, a cemented pan, and wetness.

Ponding and wetness severely limit this unit for local roads. Drainage ditches along the roads help reduce the ponding and lower the water table. This unit is severely limited for septic tank absorption fields by ponding, slow permeability, and a cemented pan. It is generally not suitable for this use.

These soils are in capability subclass IVw. The Saugatuck soil is in woodland suitability subclass 5w, and the Pipestone soil is in woodland suitability subclass 3s.

Sb—Sebewa loam, shaly sand substratum. This nearly level or depressional soil is deep and very poorly drained. It is on broad flats or in slight depressions and is intermingled with poorly drained soils or other very poorly drained soils. It is frequently ponded by surface runoff from adjacent, higher lying parts of the landscape. Individual areas are usually broad and irregular in shape. They range from 3 to 700 acres in size but are dominantly about 100 acres.

In a typical profile the surface layer is black loam about 9 inches thick. The subsurface layer is very dark brown clay loam about 7 inches thick. The subsoil is about 20 inches thick. The upper part is gray, mottled, firm clay loam, and the lower part is grayish brown, mottled, friable sandy clay loam. To a depth of 60 inches the substratum is grayish brown, mottled sand, shaly and gravelly sand, and coarse sand that is calcareous. In some areas the subsoil is sandy loam. In some lower areas the surface layer is mucky loam. In places the solum is more than 40 inches thick. In some areas this soil has brownish parts that have higher concentrations of iron. There may be concretions present. In these areas, most of which are in the southern part of the county, tillage or crop yields are not affected by the higher concentrations of iron or the concretions.

Included with this soil in mapping are a few small areas of better drained soils that have slightly convex slopes. This soil has a dark surface layer that is only as thick as the plow layer and has a mottled subsoil. This inclusion makes up about 5 to 8 percent of the unit.

This Sebewa soil has moderate available water capacity and is moderately permeable in the subsoil and rapidly permeable in the underlying material. Surface runoff is very slow or ponds. This soil has a prolonged seasonal high water table above or near the surface in early spring. It has a friable surface layer that is easy to till under proper moisture conditions. The surface layer becomes cloddy and hard to work if tilled when it is too wet. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to growing corn, soybeans, and some small grain. It is poorly suited to winter wheat because ponding usually destroys stands. Wetness and wind erosion are the main limitations that affect the use and management of this soil. Excessive water can be removed by open ditches, subsurface drains, surface drains, pumping, or a combination of these practices. Where drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage and using crop residue in or on top of the plow layer help improve and maintain tilth and organic matter content and help control wind erosion.

This soil is suited to grasses and legumes for hay or pasture. Draining this soil is necessary to obtain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are not as well suited to this soil as shallow rooted legumes. When this soil is used for pasture, the major concerns of management are overgrazing or grazing when the soil is wet, which causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to reduce surface compaction and to maintain good tilth and density of plants.

This soil is suited to growing trees. It is severely limited for the use of equipment. It is also severely limited by the hazards of seedling mortality, windthrow, and plant competition because the prolonged seasonal high water table is at or near the surface for long periods of time. Wetness restricts harvesting trees to dry seasons or periods when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Replanting of seedlings is often needed. Survival and growth of seedlings are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited and is generally unsuitable for building sites because of ponding. Ponding and frost action severely limit this soil for local roads and streets. Drainage ditches along the roads to lower the water table and elevating the roadbed help reduce the frost damage and ponding. This soil is severely limited and is generally unsuitable for septic tank absorption fields because of ponding and poor filtering qualities. Effluent can seep into ground water supplies.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

SeA—Selfridge loamy fine sand, 0 to 2 percent slopes. This nearly level soil is deep and somewhat poorly drained. It is on slightly convex beach ridges, outwash plains, and low sand dunes. Individual areas are irregular in shape. They range from 3 to 200 acres in size but are dominantly about 20 acres.

In a typical profile the surface layer is dark grayish brown loamy fine sand about 8 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown, mottled, very friable loamy fine sand; the next part is pale brown, loose sand; the next part is dark yellowish brown, mottled friable sandy loam; and the lower part is brown and dark grayish brown, mottled, very firm clay loam. The substratum is brown, mottled clay loam to a depth of 60 inches. In some areas the soil has a surface layer of sandy loam, and in a few areas the soil is gently sloping and higher on the landscape.

Included with this soil in mapping are a few small areas of Brems soils that are on slightly higher parts of the landscape and Cheektowaga soils that are in depressions. These inclusions make up about 12 to 15 percent of the unit.

This Selfridge soil has moderate available water capacity. It is rapidly permeable in the upper part of the solum and is moderately permeable or moderately slowly permeable in the lower part of the solum and the substratum. Surface runoff is slow. The soil has a seasonal high water table that is at a depth of 1 foot to 2 feet during the spring. The surface layer is medium acid or slightly acid, unless it is limed. It is very friable and easily tilled through a fairly wide range in moisture content. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and some are in woodland.

This soil is suited to growing corn, soybeans, and small grain. Wetness is the main limitation that affects the use and management of this soil. Excessive water can be removed by open ditches, subsurface drains, pumping, or a combination of these practices. Where drained and properly managed, this soil is suited to intensive row cropping. Using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain help maintain tilth and improve and maintain organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because of the seasonal high water table and the shallow depth to calcareous till or lacustrine material. When this soil is used for pasture, the main concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to growing trees. Plant competition and seedling mortality are moderate limitations when this soil is planted to trees. Seasonal wetness can cause a slight delay in harvesting or planting. Species that can tolerate wet conditions should be favored in stands. Some replanting of seedlings might be needed. Survival and growth of seedlings are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites by wetness. An adequate drainage system is needed to satisfactorily lower the water table. Dwellings should be constructed without basements. Frost action severely limits this soil for local roads and streets. Drainage ditches along the roads to lower the water table and elevating the roadbed help overcome frost action. This soil is severely limited for septic tank absorption fields by wetness and moderately slow permeability. Increasing the size of the absorption field in drained areas helps septic systems to function more efficiently.

This soil is in capability subclass IIIw and woodland suitability subclass 3s.

SeB—Selfridge loamy fine sand, 2 to 6 percent slopes. This gently sloping soil is deep and somewhat poorly drained. It is on convex beach ridges, outwash plains, and low sand dunes. Individual areas are irregular in shape. They range from 3 to 90 acres in size but are dominantly about 12 acres.

In a typical profile the surface layer is dark brown loamy fine sand about 9 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown and dark brown, very friable loamy fine sand; the middle part is dark yellowish brown, mottled, firm sandy clay loam; and the lower part is gray, mottled, very firm silty clay loam. The substratum is gray, mottled clay loam to a depth of 60 inches. In some areas the surface layer is sandy loam. In a few areas the soil has slope of less than 2 percent or more than 6 percent.

Included with this soil in mapping are a few small areas of Brems soils on similar positions in the landscape and Morley soils on higher positions. These inclusions make up about 5 to 8 percent of the unit.

This Selfridge soil has moderate available water capacity. It is rapidly permeable in the upper part of the solum and moderately permeable or moderately slowly permeable in the lower part of the solum and in the substratum. Surface runoff is slow. This soil has a seasonal high water table that is at a depth of 1 foot to 2 feet during the spring. The surface layer is medium acid or slightly acid, unless it is limed. It is very friable and easily tilled through a fairly wide range in moisture content. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and some are in woodland.

This soil is suited to growing corn, soybeans, and small grain. Conservation practices are needed to control erosion when cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain also help control erosion and help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because of the seasonal high water table and the shallow depth to calcareous till or lacustrine material. When this soil is used for pasture, the main concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to growing trees. Plant competition and seedling mortality are moderate limitations when this soil is planted to trees. Some replanting of seedlings might be needed. Survival and growth of seedlings are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites by wetness. An adequate drainage system is needed to satisfactorily lower the water table. Dwellings should be constructed without basements. Frost action severely limits this soil for local roads and streets. Drainage ditches along the roads to lower the water table and elevating the roadbed help overcome the frost action. This soil is severely limited for septic tank absorption fields by wetness and moderately slow permeability. Increasing the size of the absorption field in drained areas helps septic systems to function more efficiently.

This soil is in capability subclass IIIe and woodland suitability subclass 3s.

So—Suman silty clay loam. This nearly level soil is deep and very poorly drained. It is on flood plains. It is frequently flooded for brief periods of time. Individual areas are generally elongated. They range from 3 to 125 acres in size but are dominantly about 12 acres.

In a typical profile the surface layer is black silty clay loam about 13 inches thick. The subsurface layer is very dark gray silty clay loam about 9 inches thick. The subsoil is about 12 inches thick. It is dark gray, mottled firm clay loam. To a depth of 60 inches, the substratum is light brownish gray, dark brown, and dark gray stratified layers of loamy fine sand and fine sand. It is mottled. In some areas the surface layer is dark gray, the subsoil is silt loam, or the substratum is not stratified layers. In a few areas organic matter decreases regularly with depth.

Included with this soil in mapping are some small areas of Adrian and Cohoctah soils and Fluvaquents. These inclusions make up about 10 to 15 percent of the unit.

This Suman soil has moderate available water capacity and is moderately slowly permeable in the subsoil and rapidly permeable in the substratum. Surface runoff is very slow or ponds. This soil has a seasonal water table that ranges from the surface to a depth of 0.5 foot during a significant part of the year. It is firm but becomes cloddy and hard to work if tilled when too wet. It is high in organic matter content.

Some areas of this soil are used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is suited to growing corn, soybeans, and some small grain. It is poorly suited to winter wheat because ponding or flooding usually destroys stands, unless the area is adequately protected from flooding. Wetness and flooding are the main limitations that affect the use and management of this soil. Excessive water can be removed by open ditches, subsurface drains, surface drains, pumping, or a combination of these practices. Where drained and adequately protected from flooding, this soil is suited to intensive row cropping. Conservation tillage and using crop residue in or on top of the plow layer help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are poorly suited to this soil because of the high water table. When this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to growing trees, but only a few areas are in woodland. The soil is severely limited for the use of equipment. It is also severely limited by the hazards of plant competition, seedling mortality, and windthrow because the water table is at or near the surface for long periods of time. Wetness restricts harvesting trees to dry seasons or periods when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Some replanting of seedlings might be necessary to maintain density of stands. Survival and growth of seedlings are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for building sites by wetness and flooding. It is generally unsuitable for this use. Wetness, flooding, and low strength severely limit this soil for local roads. Drainage ditches along the roads to lower the water table helps overcome the frost action. The flooding conditions are difficult to overcome. Elevating the roadbed above the original surface helps overcome some problems of wetness. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic. Wetness, flooding, and the moderately slow permeability severely limit this soil for septic tank absorption fields. This soil is generally not suitable for septic tank absorption fields.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

TcA—Tracy sandy loam, 0 to 2 percent slopes. This nearly level soil is deep and well drained. It is on broad flats of uplands. Individual areas are usually broad and irregular in shape. They range from 3 to 500 acres in size but are dominantly about 30 acres.

In a typical profile the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsoil is about 45 inches thick. The upper part is dark brown, friable sandy loam; the next part is yellowish brown, very friable loamy sand; the next part is dark yellowish brown, friable gravelly sandy loam and gravelly sandy clay loam; and the lower part is brown and dark yellowish brown, loose fine gravelly sand that has minor, thin layers of gravelly sandy loam and gravelly sandy clay loam. The substratum is strata of pale brown sand and loamy sand to a depth of 60 inches. In some areas the surface layer is black or very dark gray. In some places the solum is less than 40 inches thick. There are some areas where the depth to free carbonates is less than 60 inches and the soil is less acid than normal. Also, in a few areas the soil has slope of more than 2 percent.

Included with this soil in mapping are a few small areas of Riddles and Tyner soils that make up about 5 to 10 percent of the unit.

This Tracy soil has moderate available water capacity. It is moderately permeable in the solum and rapidly permeable in the substratum. Surface runoff is slow. The surface layer varies in reaction as a result of local liming practices. It is friable and easily tilled through a fairly wide range in moisture content. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few are in orchards and woodland.

This soil is well suited to growing corn, soybeans, and small grain. Conservation practices are needed to control wind erosion when cultivated crops are grown. Using crop residue in or on top of the plow layer, a cover crop of grasses, legumes, or small grain, and conservation tillage help control wind erosion and help improve and maintain tilth and organic matter content of this soil. Droughtiness is a problem during seasons when rainfall is poorly distributed.

This soil is suited to grasses and legumes for hay or pasture. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. A few areas are in orchards. Plant competition is the main limitation when this soil is planted to trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is suitable for building sites and for septic tank absorption fields. It is moderately limited for local roads and streets by frost action. Constructing roads on well compacted fill material helps overcome frost damage.

This soil is in capability subclass IIs and woodland suitability subclass 1o.

TcB—Tracy sandy loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on broad, convex ridgetops, long side slopes, and toe slopes of uplands. Individual areas are usually broad and irregular in shape. They range from 4 to 260 acres in size but are dominantly about 30 acres.

In a typical profile the surface layer is dark brown sandy loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is dark brown, friable sandy loam and loam; the middle part is dark brown, friable gravelly sandy clay loam and gravelly sandy loam; and the lower part is dark brown, friable sandy loam. The substratum is pale brown and dark brown strata of sand and loamy sand to a depth of 60 inches. In some places the solum is less than 40 inches thick. In some areas free carbonates are less than 60 inches deep, and the soil is less acid than normal. In a few small areas the soil has slope of less than 2 percent or more than 6 percent. In some areas the soil is severely eroded and the plow layer consists mostly of material from the subsoil. In these areas noticeable amounts of shale are on the surface.

Included with this soil in mapping are a few small areas of Chelsea and Riddles soils. These inclusions make up about 5 to 12 percent of the unit.

This Tracy soil has moderate available water capacity. It is moderately permeable in the solum and rapidly permeable in the substratum. Surface runoff from cultivated areas is moderate. The surface layer varies in reaction as a result of local liming practices. It is friable and easily tilled through a fairly wide range in moisture content. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few are in orchards and woodland.

This soil is well suited to growing corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. Using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain also help control wind and water erosion and help improve and maintain tilth and organic matter content. Droughtiness is a problem during seasons when rainfall is poorly distributed.

This soil is suited to grasses and legumes for hay or pasture. When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. A few areas are in orchards. Plant competition is the main limitation when this soil is planted to trees. Seedlings survive and grow well if competing vegetation is controlled.

Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is suitable for dwellings and for septic tank absorption fields. Frost action moderately limits this soil for local roads and streets. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps support vehicular traffic and reduce frost heaving.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

TcC2—Tracy sandy loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is deep and well drained. It is on convex ridgetops and side slopes of uplands. Individual areas are fairly small and irregular in shape. They range from 3 to 40 acres in size but are dominantly about 15 acres.

In a typical profile the surface layer is dark brown sandy loam about 5 inches thick. The subsoil is about 36 inches thick. It is yellowish brown and dark yellowish brown, friable sandy loam. To a depth of about 60 inches, the substratum is brown and dark yellowish brown loamy sand that has bands of light yellowish brown and yellowish brown sand. In some places the solum is less than 40 inches thick. In some areas free carbonates are less than 60 inches deep, and the soil is less acid than normal. In a few small areas the soil has slope of less than 6 percent or more than 12 percent. In some areas the soil is severely eroded and the plow layer consists mostly of material from the subsoil. In these areas noticeable amounts of shale are on the surface.

Included with this soil in mapping are a few small areas of Chelsea and Riddles soils. These inclusions make up about 3 to 8 percent of the unit.

This Tracy soil has moderate available water capacity. It is moderately permeable in the solum and rapidly permeable in the substratum. Surface runoff from cultivated areas is rapid. The surface layer varies in reaction as a result of local liming practices. It is friable and easily tilled through a fairly wide range in moisture content. It is moderate in organic matter content.

Some areas of this soil are used for cultivated crops. Some are used for hay or pasture, and others are in orchards and woodland.

This soil is suited to growing corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. The practices used need to fit both the delineation of the area and the practices in use on the surrounding soils that are being farmed. The use of crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain also help control wind and water erosion and help improve and maintain tilth and organic matter content. Droughtiness is also a problem during seasons when rainfall is poorly distributed.

When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants and causes excessive runoff. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. Plant competition is the main limitation when this soil is planted to trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is moderately limited for dwellings by slope. Developing one lot at a time while retaining as much existing vegetation as possible during construction helps reduce soil erosion. Other measures to reduce erosion are: Designing housing so roads follow the contour of the slope, have diversions between lots to intercept runoff, and stockpile topsoil and return it. The topsoil should then be reseeded as quickly as possible to desired grasses to reduce the possibility of erosion. Slope and frost action moderately limit this soil for local roads and streets. Cuts and fills are needed, and roads should be built on the contour where possible. Constructing roads on well compacted fill material helps overcome frost damage. This soil is moderately limited for septic tank absorption fields by slope. Land shaping and installing the distribution lines across the slope is generally necessary for proper functioning of the absorption field. To obtain the amount of field needed might require using only one or two lines and extending them for greater distances.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

TcD2—Tracy sandy loam, 12 to 18 percent slopes, eroded. This strongly sloping soil is deep and well drained. It is on ridgetops and side slopes and along drainageways of uplands. Individual areas are irregular in shape. They range from 3 to 80 acres in size but are dominantly about 15 acres.

In a typical profile the surface layer is dark grayish brown sandy loam about 5 inches thick. The subsoil is about 49 inches thick. The upper part is dark yellowish brown, friable sandy loam, and the lower part is yellowish brown, friable loamy sand. The substratum is yellowish brown sand that has bands of dark yellowish brown loamy sand to a depth of 60 inches. In some places the solum is less than 40 inches thick. In some areas free carbonates are less than 60 inches deep, and the soil is less acid than normal. In few small areas the soil has slope of less than 12 percent, and in some areas slope is more than 18 percent. In some areas the soil is severely eroded, and the plow layer consists mostly of material from the subsoil. In these areas noticeable amounts of shale are on the surface.

Included with this soil in mapping are a few small areas of Chelsea and Riddles soils. These inclusions make up about 5 to 12 percent of the unit.

This Tracy soil has moderate available water capacity. It is moderately permeable in the solum and rapidly permeable in the substratum. Surface runoff is very rapid. The surface layer varies widely in reaction as a result of local liming practices. It is friable and is moderate in organic matter content.

Some areas of this soil are used for cultivated crops. Others are used for hay or pasture or are in orchards and woodland.

This soil is poorly suited to growing corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. The use of some machinery is restricted by slope. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help prevent excessive soil loss. The practices used need to fit both the delineation of the area and the practices in use on the surrounding soils that are being farmed. Using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain also help control wind and water erosion and help improve and maintain tilth and organic matter content.

When this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces the density and hardiness of plants and causes excessive runoff. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. Plant competition is the main limitation when this soil is planted to trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited for dwellings by slope. Developing one lot at a time while retaining as much existing vegetation as possible during construction helps reduce soil erosion. Other measures to reduce erosion are: Designing housing so the roads follow the contour of the slope, having diversions between lots to intercept runoff, and stockpiling topsoil and returning it. The topsoil then should be reseeded as quickly as possible to desired grasses to reduce the possibility of erosion. Slope severely limits this soil for local roads and streets. Roads should be built on the contour where possible. Extensive road cuts might be necessary. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps support vehicular traffic. This soil is severely limited for septic tank absorption fields by slope. Land shaping and installing the distribution lines across the slope is generally necessary for proper functioning of the absorption field. To obtain the amount of field needed might require the use of one or two lines and extending them for greater distances. Machinery to install the lines cannot work on some of these slopes.

This soil is in capability subclass IVe and woodland suitability subclass 1o.

TcF—Tracy sandy loam, 25 to 45 percent slopes. This steep and very steep soil is deep and well drained. It is on ridgetops and side slopes and along the drainageways of uplands. Individual areas are irregular in shape. They range from 2 to 40 acres in size but are dominantly about 15 acres.

In a typical profile the surface layer is brown sandy loam about 3 inches thick. The subsurface layer is yellowish brown sandy loam about 8 inches thick. The subsoil is about 39 inches thick. It is brown, friable sandy loam. The substratum is yellowish brown sand over strong brown gravelly sand to a depth of 60 inches. In some places the subsoil is less than 39 inches thick. In some areas free carbonates are less than 60 inches deep, and the soil is less acid than normal. In some small areas the soil has more sand throughout. In a few small areas the soil has slope of less than 25 percent, and in some areas slope is more than 45 percent.

Included with this soil in mapping are a few small areas of Riddles soils that make up about 3 to 8 percent of the unit.

This Tracy soil has moderate available water capacity and is moderately permeable in the solum and rapidly permeable in the substratum. Surface runoff is very rapid. The surface layer is generally strongly acid. It is friable and is moderate in organic matter.

Most areas of this soil are in woodland. Some urban development has taken place on this soil.

This soil is suited to growing trees, and most areas are in woodland. The main limitation is trying to use equipment on the steep slopes. Also if areas are disturbed, then the possibility of surface erosion becomes much greater. Plant competition is also a moderate problem on these soils. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying or girdling.

This soil is severely limited and generally unsuitable for building sites because of slope. Slope severely limits this soil for local roads. Extensive road cuts might be necessary. Frost action is a moderate limitation for local roads and streets. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support heavier loads. This soil is severely limited for septic tank absorption fields by slope. It is generally not suitable for septic tank absorption fields.

This soil is in capability subclass VIe and woodland suitability subclass 1o.

Tr—Troxel silt loam. This nearly level or depressional soil is deep and well drained. It is in small potholes on outwash and glacial plains. Individual areas are small and generally rounded in shape. They range from 2 to 5 acres in size.

In a typical profile the surface layer is black silt loam about 10 inches thick. The subsurface layer is black and very dark gray silt loam in the upper 20 inches and dark brown silt loam in the lower 5 inches. The subsoil is 25 inches thick. The upper part is brown, friable loam; the middle part is dark brown, friable loamy sand; and the lower part is dark brown sand. The substratum is dark yellowish brown sand to a depth of 80 inches. In some places the subsoil is thicker or thinner. In some places the dark colored surface layer is less than 24 inches thick. There are a few areas where the soil is sandy loam throughout. In some places the organic matter decreases regularly with depth.

This Troxel soil has high available water capacity and is moderately permeable. Surface runoff is very slow or ponds for brief periods of time. The surface layer varies widely in reaction as a result of local liming practices. It is friable and easily tilled through a fairly wide range in moisture content. It is moderate in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and some are in woodland.

This soil is well suited to growing corn, soybeans, and small grain. Occasional brief ponding is the main limitation that affects the use and management of this soil. This soil is suited to intensive row cropping. Using crop residue in or on top of the plow layer and a cover crop of grasses, legumes, or small grain help improve and maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. When this soil is used for pasture, the main concerns of managment are overgrazing and grazing when the soil is wet, which causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is not rated for timber production since trees are not native to these soils. If trees are planted, they are generally used as windbreaks.

This soil has a severe limitation of flooding and is generally not suitable for building sites. Frost action, flooding, and low strength of material severely limit this soil for local roads and streets. Drainage ditches along the roads to lower the water table help overcome frost action. Elevating the roadbed above the high water level also helps overcome frost action and flooding. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic. This soil is severely limited for septic tank absorption fields by flooding. It is generally not suitable for absorption fields.

This soil is in capability class I. It is not assigned to a woodland suitability subclass.

TyA—Tyner loamy sand, 0 to 2 percent slopes. This nearly level soil is deep and somewhat excessively drained. It is on slightly convex outwash plains. Individual areas are usually broad and irregular in shape. They range from 3 to 750 acres in size but are dominantly about 65 acres.

In a typical profile the upper part of the surface layer is dark brown loamy sand about 10 inches thick, and the lower part is dark yellowish brown loamy sand about 3 inches thick. The subsoil is yellowish brown, very friable loamy sand about 27 inches thick. The substratum is brownish yellow sand to a depth of 60 inches. In some areas thin bands of sandy loam material are in the substratum. There are some areas where the soil is sandy throughout. In a few small areas the soil has slope of more than 2 percent.

Included with this soil in mapping are a few small areas of Brems and Tracy soils. These inclusions make up about 3 to 8 percent of the unit.

This soil has moderate available water capacity and is rapidly permeable in the solum and very rapidly permeable in the substratum. Surface runoff is slow. The surface layer varies widely in reaction as a result of local liming practices. It is friable and easily tilled through a fairly wide range in moisture content. It is low in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few are in woodland.

This soil is suited to growing corn, soybeans, and small grain. Droughtiness is the main limitation for use and management of the soil. Windbreaks, crop rotation, and conservation tillage are needed to prevent excessive soil loss from wind erosion. Using crop residue in or on top of the soil and a cover crop of legumes, grasses, or small grain also help control wind erosion and help improve and maintain tilth and the organic matter content.

The soil is suited to grasses and legumes for hay or pasture. Overgrazing reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to growing trees. A few areas are in orchards or woodland. The soil is limited moderately by the hazard of seedling mortality because of the droughty conditions. Tree seedlings should be planted as early as possible in the spring. Some replanting of seedlings might be needed. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is suitable for building sites and local roads and streets. It is severely limited for septic tank absorption fields by poor filtering qualities. Where used, absorption fields can pollute nearby shallow wells.

This soil is in capability subclass IIIs and woodland suitability subclass 3s.

Ua—Udorthents, loamy. This nearly level to steep soil is on outwash plains, lake plains, till plains, and the moraine. Individual areas are fairly small and range from 3 to 100 acres but are dominantly 20 acres.

In a typical area of Udorthents, loamy, the surface layer is dark brown or brown sandy loam or loam. In some pedons it is very dark grayish brown, dark yellowish brown, yellowish brown, or brownish gray and is loamy sand, sandy clay loam, silt loam, or silty clay loam. The underlying layers are yellowish brown, brownish yellow, brown, and pale brown and include loam, sandy loam, loamy sand, and some sandy clay loam and silty clay loam. In some pedons there are gray mottles. In most areas the surface layer and some underlying layers have been removed. In some areas the surface layer has been reworked and mixed with the underlying layers, and in some areas the upper layers are loamy material that has been transported from another site. The disturbance of these areas is so great that the type of soil cannot be recognized.

Included with this soil in mapping are some areas of sandy soil and a few areas of soil that is clay loam. Also included are some areas that have very steep cuts that were made to remove the soil material. Some pits where gravel and sand are being mined are included. There are a few, very small bodies of water in some of the areas, and a few small areas of the surrounding soils are included. These inclusions make up about 15 percent of the unit.

This soil is used for commercial building sites, borrow pits, interstate highway interchanges, sanitary landfills, and other large projects that require extensive earthmoving.

This soil is suited to growing grasses for cover. The grass provides protection from erosion on slopes. When planted to grasses for cover and protection, additions of lime and fertilizer should be made according to soil tests and plant needs because the soil is extremely variable.

This unit is used for large construction sites but is not used for houses. Onsite investigations are usually required for most uses. Limitations are usually overcome for construction by earthmoving. Erosion should be controlled. Limitations for septic tank absorption fields are variable. Onsite investigations are needed for all construction sites.

This soil is not assigned to a capability subclass or woodland suitability subclass.

Uc—Urban land-Coupee complex. This map unit consists of areas of urban land and nearly level Coupee soil that is deep and well drained. This map unit is made up of about 55 percent urban land and about 40 percent Coupee soil. Individual areas are on outwash plains. They are usually large and range from 25 to 300 acres in size. Most areas are located in the town of La Porte.

In a typical area of urban land there are streets, parking lots, shopping centers, houses, buildings, and other structures that cover the surface so that the type of soil can not be recognized.

In a typical profile of the Coupee soil, the surface layer is very dark brown silt loam about 10 inches thick, and the subsurface layer is dark brown silt loam about 6 inches thick. The subsoil is about 21 inches thick. The upper part is dark yellowish brown, firm clay loam, and the lower part is dark yellowish brown, friable sandy clay loam. The substratum is dark brown loamy sand and gravelly sandy loam to a depth of about 60 inches. There are some areas where the surface layer is lighter colored, and some areas where the dark colored surface layer is less than 10 inches thick. In some areas the soil has slope of more than 2 percent.

Included with this unit in mapping are a few depressional areas of Troxel soils that make up about 3 to 8 percent of the unit.

The Coupee soil in this unit has moderate available water capacity and is moderately permeable in the upper part and very rapidly permeable in the lower part. Surface runoff is slow to medium. The surface layer is strongly acid, unless it is limed. It is moderate in organic matter content.

Most of this unit is used for building sites. A few areas are idle or are used for playgrounds or recreational facilities.

This unit is not used for growing crops, forage, or woodland. When small areas are used for garden plots and lawn, lime and fertilizer should be added according to soil tests and plant needs. Watering of lawns and garden plots is needed during dry periods. When planting trees and shrubs, competing vegetation needs to be controlled.

The Coupee soil is suitable for building sites. It is moderately limited for local roads and streets by low strength. The base material for roads needs strengthening with a material that is suitable to support traffic. Poor filtering qualities severely limit this soil for septic tank absorption fields. Although sewage effluent is readily absorbed into the soil, pollution of ground water supplies can become a problem.

This soil is not assigned to a capability subclass and woodland suitability subclass.

UoC—Urban land-Oakville complex, 1 to 10 percent slopes. This map unit consists of areas of urban land and nearly level to moderately sloping Oakville soils that are deep and well drained. This map unit is made up of about 55 percent urban land and about 40 percent Oakville soils. Individual areas are on lake plains, low sand dunes, and beach ridges. They are usually large and range from 50 to 200 acres in size. Most areas are located in Michigan City.

In a typical area of urban land there are streets, parking lots, shopping centers, houses, buildings, and other structures that cover the surface so that the type of soil cannot be recognized.

In a typical profile of the Oakville soil, the surface layer is black fine sand about 4 inches thick. The subsurface layer is dark grayish brown fine sand about 11 inches thick. The subsoil is yellowish brown, loose fine sand about 27 inches thick. The substratum is light yellowish brown fine sand to a depth of 60 inches. There are some areas where thin bands of loamy sand are in the substratum. In some areas the soil is strongly acid or very strongly acid, and in a few areas the soil has slope of more than 10 percent.

Included with this unit in mapping are a few areas of nearly level Brems soils that make up about 8 to 12 percent of the unit.

The Oakville soils in this unit have low available water capacity and are very rapidly permeable. Surface runoff is slow or medium. The surface layer is neutral. It is moderate in organic matter content.

Most of this unit is used for building sites. A few areas are idle or are used for playgrounds or recreational facilities.

This unit is not used for growing crops, forage, or woodland. When small areas are used for garden plots and lawn, lime and fertilizer should be added according to soil tests and plant needs. Droughtiness is a limitation, and watering of lawns and garden plots is usually needed. When planting trees and shrubs, seedling mortality is a problem unless sufficient moisture is applied at regular intervals until plants become established.

The Oakville soil is suitable for dwellings where the slope is less than 8 percent. In most excavations banks slough or cave in. Trench walls should be reinforced to prevent caving in. This soil is suitable for local roads and streets where the slope is less than 8 percent. It is moderately limited where the slope is more than 8 percent. Cuts and fills are needed and roads should be built on the contour of the slope where possible. Poor filtering qualities severely limit this soil for septic tank absorption fields. Sanitary facilities should be connected to commercial sewers and treatment facilities. Ground water supplies can be polluted if septic tank absorption fields are used.

This soil is not assigned to a capability subclass and woodland suitability subclass.

Uv—Urban land-Morocco complex. This map unit consists of areas of urban land and nearly level Morocco soils that are deep and somewhat poorly drained. This map unit is in about 55 percent urban land and about 40 percent Morocco soils. Individual areas are on outwash plains. They are usually large and range from 40 to 100 acres in size. Most areas are located in Michigan City.

In a typical area of urban land there are streets, parking lots, shopping centers, houses, buildings, and other structures that cover the surface so that the type of soil cannot be recognized.

In a typical profile of the Morocco soil, the surface layer is very dark gray loamy fine sand about 6 inches thick. The subsurface layer is yellowish brown loamy sand about 8 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, mottled, friable loamy sand, and the lower part is pale brown and very pale brown, mottled, loose very fine sand. The substratum is brown and pale brown, mottled coarse and medium sand to a depth of 60 inches. In a few areas the soil has slope of more than 2 percent, or it has a lighter colored subsoil.

Included with this unit in mapping are a few areas of Maumee and Newton soils in depressions. These inclusions make up about 5 to 12 percent of the unit.

The Morocco soil in this unit has low available water capacity and is rapidly permeable. Surface runoff is very slow. This soil has a seasonal high water table that is within 1 foot to 2 feet of the surface in the spring. The surface layer is strongly acid to very strongly acid, unless it is limed. It is moderate in organic matter content.

Most of this unit is used for building sites. A few areas are idle or are used for playgrounds or recreational facilities.

This unit is not used for crops, forage, or woodland. When small areas are used for garden plots and lawn, lime and fertilizer should be added according to soil tests and plant needs. Droughtiness is a limitation when the area has been drained to build houses, and lawns and garden plots usually need to be watered during dry periods. When planting trees and shrubs, seedling mortality is a problem when the seasonal water table is high. During dry periods the soil becomes droughty if it is drained. Sufficient moisture should be applied at regular intervals until the plants become established.

The Morocco soil is severely limited for building sites by wetness. Houses should be constructed without basements because the seasonal high water table is within a depth of 1 foot to 2 feet of the surface. Banks cave in or slough in most excavations. Trench walls should be reinforced to prevent caving in. Wetness and frost action moderately limit this soil for local roads and streets. Drainage ditches along the roads to lower the water table and elevating the roadbed help to remove excess water and reduce the frost action. This soil is severely limited for septic tank absorption fields by wetness and poor filtering qualities. Sanitary facilities should be connected to commercial sewers and treatment facilities.

This soil is not assigned to a capability subclass and woodland suitability subclass.

Wa—Wallkill silt loam. This nearly level soil is deep and very poorly drained. It is in narrow depressions and around broad, flat areas of organic soils that are next to uplands. It is frequently ponded by surface runoff from adjacent higher lying parts of the landscape. Individual areas are usually fairly small and somewhat elongated in shape. They range from 3 to 22 acres in size.

In a typical profile the upper part of the surface layer is dark grayish brown silt loam about 3 inches thick, and the lower part is dark grayish brown silty clay loam about 7 inches thick. The subsoil is olive gray, mottled, firm silty clay loam about 10 inches thick. Between 20 and 27 inches, the lower part of the alluvium is dark gray, firm silty clay loam. The substratum is dark reddish brown muck to a depth of 60 inches. In some areas the surface layer is lighter colored. In some places the alluvium is less than 20 inches thick. In others the depth to the organic material is more than 40 inches thick. In some areas sand is at a depth of 50 inches. In a few areas the soil has slope of more than 2 percent.

Included with this soil in mapping are a few areas of Pewamo soils in depressions. This inclusion makes up about 5 to 12 percent of the unit.

This Wallkill soil has high available water capacity. It is moderately permeable in the mineral soil and moderately slowly permeable to moderately rapidly permeable in the organic material. Surface runoff is very slow or ponds. This soil has a prolonged seasonal high water table at or near the surface, and in some areas it is ponded in early spring. The surface layer is friable and easy to till under proper moisture conditions. It is high in organic matter content.

Some areas of this soil are used for cultivated crops. Others are used for hay or pasture or are in woodlands.

This soil is suited to growing corn, soybeans, and some small grain. It is poorly suited to winter wheat because ponding usually destroys stands. Wetness is the main limitation that affects the use and management of this soil. Excessive water can be removed by subsurface drains, surface drains, grassed waterways, pumping, or a combination of these practices. When drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage and using crop residue in or on top of the plow layer help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are not as well suited to this soil as shallow rooted legumes. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to trees, and only a few areas are in trees. It is severely limited for the use of equipment. The hazards of seedling mortality and windthrow are severe because the seasonal high water table is at or near the surface for long periods of time. Wetness restricts harvesting trees to dry seasons or periods when the ground is frozen. Species which are tolerant of wetness should be favored in stands. Some replanting of seedlings is usually needed. Survival and growth of seedlings are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited and is generally unsuitable for building sites because of ponding and low strength. Ponding and low strength severely limit this soil for local roads and streets. The organic matter should be removed and suitable material used as fill to strengthen the base. Drainage ditches along the roads help lower the water table. This soil is severely limited for septic tank absorption fields by ponding. It is generally not suitable for absorption fields.

This soil is in capability subclass IIIw and woodland suitability subclass 4w.

We—Warners silt loam. This nearly level soil is deep and very poorly drained. It is on flood plains. It is frequently ponded by surface runoff from adjacent higher lying parts of the landscape. Individual areas are irregular in shape. They range from 3 to 50 acres but are dominantly about 10 acres.

In a typical profile the upper 10 inches of the surface layer is very dark gray silt loam; the lower 3 inches is dark grayish brown, mottled silt loam. The upper part of the subsurface layer is dark gray, mottled silt loam about 4 inches thick; the lower part is black, mucky silt loam about 3 inches thick. The substratum is white, mottled marl to a depth of 54 inches and is gray marl to a depth of 60 inches. In some areas the mineral material is less than 12 inches over marl. In other small areas organic material is above the marl. In some areas slope is more than 2 percent.

Included with this soil in mapping are some small areas of Gilford soils. This inclusion makes up about 3 to 12 percent of the unit.

This Warners soil has low available water capacity. It is moderately slowly permeable or moderately permeable in the mineral material and variable in the marl. Surface runoff is very slow or ponds. This soil has a prolonged seasonal high water table at or near the surface, and in some areas the soil is ponded in early spring. The surface layer is neutral or mildly alkaline. It is friable and easy to till under proper moisture conditions. It becomes cloddy and hard to work if it is tilled when too wet. It is high in organic matter content.

Most areas of this soil are drained and used for cultivated crops. Some areas are used for hay or pasture, and some are in woodland.

This soil is suited to growing corn, soybeans, and some small grain. It is poorly suited to winter wheat because ponding usually destroys stands. Wetness is the main limitation that affects the use and management of this soil. Excessive water can be removed by open ditches, surface drains, pumping, or a combination of these practices. When drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage and using crop residue in or on top of the plow layer help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are not as well suited to this soil as shallow rooted legumes. When this soil is used for pasture, the main concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is poorly suited to trees, and only a few areas are in woodland. It is severely limited for the use of equipment. The hazards of seedling mortality and windthrow are severe because the seasonal high water table is at or near the surface for long periods of time. Wetness restricts harvesting trees to dry seasons or periods when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Replanting seedlings is often needed to maintain density of stands. Seedlings survive and grow if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited and is generally unsuitable for dwellings because of ponding. Ponding and frost action severely limit this soil for local roads. Drainage ditches along the roads to lower the water table and elevating the roadbed help overcome the frost action. This soil is generally not suitable for septic tank absorption fields because of ponding.

This soil is in capability subclass IIIw and woodland suitability subclass 5w.

Wh—Washtenaw silt loam. This nearly level, deep soil is poorly drained. It is in depressions on the moraine, till plains, and outwash plains. It is frequently ponded by surface runoff from adjacent higher lying parts of the landscape. Individual areas are small and somewhat elongated. They range from 3 to 15 acres in size.

In a typical profile the surface layer is grayish brown silt loam about 5 inches thick. Between depths of 5 and 29 inches, the subsoil is grayish brown and light brownish gray, mottled silt loam. Between depths of about 29 and 55 inches, the buried soil has the following sequence: The upper part is black, firm silty clay loam; the middle part is grayish brown, mottled, friable silt loam; and the lower part is black, mottled, friable silty clay loam. The substratum is dark gray silty clay loam to a depth of 60 inches. In some areas of the prairie, the surface layer is black. In a few areas overwash is less than 20 inches thick. In a few areas organic material is below a depth of 16 inches. In other areas the soil has slope of more than 2 percent.

Included with this soil in mapping are some small areas of Pewamo soils. This inclusion makes up about 3 to 12 percent of the unit.

This Washtenaw soil has very high available water capacity. It is moderately permeable in the solum and slowly permeable in the substratum. Surface runoff is very slow or ponds. This soil has a prolonged seasonal high water table at or within 1 foot of the surface in winter and spring. The surface layer is high in organic matter content.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and some are in woodland.

This soil is suited to growing corn, soybeans, and some small grain. It is poorly suited to winter wheat because ponding usually destroy stands. Wetness is the main limitation that affects the use and management of this soil. Excessive water can be removed by open ditches, subsurface drains, surface drains, pumping, or a combination of these practices. When drained and properly managed, this soil is suited to intensive row cropping. Conservation tillage and using crop residue in or on top of the plow layer help improve and maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay or pasture. Draining this soil is necessary to attain high yields for forage or pasture. Deep rooted legumes, such as alfalfa, are not as well suited to this soil as shallow rooted legumes. When this soil is used for pasture, the major concerns of management are overgrazing and grazing when the soil is wet, which causes surface compaction and poor tilth. Overgrazing also reduces the density and hardiness of plants. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. It is severely limited for the use of equipment. Seedling mortality and plant competition are severe limitations and windthrow hazard is a moderate limitation because the seasonal high water table is at or near the surface for long periods of time. Wetness restricts harvesting trees to dry seasons or periods when the ground is frozen. Species which are tolerant to wetness should be favored in stands. Replanting of seedlings might be needed to maintain density of stands. Survival and growth of seedlings are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil is severely limited and is generally unsuitable for building sites because of ponding. Ponding and frost action severely limit this soil for local roads. Drainage ditches along the roads to lower the water table and elevating the roadbed help overcome the frost action. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic. This soil generally is not suitable for septic tank absorption fields because of ponding, and moderately slow or slow permeability.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

prime farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when it is treated and managed using acceptable farming methods. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland may now be in crops, pasture, woodland, or other land, but not urban and built-up land or water areas. It must either be used for producing food or fiber or be available for these uses.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. It also has favorable temperature and growing season, acceptable acidity or alkalinity. It has few or no rocks and is permeable to water and air. Prime farmland is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. For more detailed information on the criteria for prime farmland consult the local staff of the Soil Conservation Service.

About 252,071 acres, or nearly 65 percent, of La Porte County can meet the soil requirements for prime farmland. Areas are scattered throughout the county, occurring in all map units of the general soil map except in map unit 2. Nearly all of this prime farmland is used for corn and soybeans.

Some parts of the county have been losing some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and difficult to cultivate, and usually less productive.

Soil map units that make up prime farmland in La Porte County are listed in this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 5. The location is shown on the detailed soil maps in the back of this publication. The soil qualities that affect use and management are described in the section "Detailed soil map units."

Soils that have limitations—a high water table, flooding, or inadequate rainfall—may qualify for prime farmland if these limitations are overcome by such measures as drainage, flood control, or irrigation. In the following list, the measures needed to overcome these limitations are shown in parentheses after the map unit name. Onsite evaluation is necessary to see if these limitations have been overcome by corrective measures.

The map units that meet the soil requirements for prime farmland are:

BaA—Blount silt loam, 0 to 3 percent slopes (where drained)
Br—Bourbon sandy loam (where drained)
Cd—Cheektowaga fine sandy loam (where drained)
CoA—Coupee silt loam, 0 to 2 percent slopes
CoB—Coupee silt loam, 2 to 6 percent slopes
EsA—Elston loam, 0 to 2 percent slopes
EsB—Elston loam, 2 to 6 percent slopes
Gf—Gilford fine sandy loam (where drained)
HaA—Hanna sandy loam, 0 to 3 percent slopes
Hk—Homer loam (where drained)
Mm—Maumee loamy fine sand (where controlled drainage is used)
Mn—Maumee Variant loamy sand (where controlled drainage is used and the soil is protected from flooding)
Mp—Milford silty clay loam (where drained)
MrB2—Morley silt loam, 2 to 6 percent slopes, eroded
Nf—Newton loamy fine sand (where controlled drainage is used)
Pe—Pewamo silty clay loam (where drained)
Ph—Pinhook loam (where drained)
Qu—Quinn loam (where drained)
RlA—Riddles loam, 0 to 2 percent slopes
RlB2—Riddles loam, 2 to 6 percent slopes, eroded
Sb—Sebewa loam, shaly sand substratum (where drained)
SeA—Selfridge loamy fine sand, 0 to 2 percent slopes (where drained)
SeB—Selfridge loamy fine sand, 2 to 6 percent slopes (where drained)
So—Suman silty clay loam (where drained and protected from flooding)
TcA—Tracy sandy loam, 0 to 2 percent slopes
TcB—Tracy sandy loam, 2 to 6 percent slopes
Tr—Troxel silt loam
Wa—Wallkill silt loam (where drained)
We—Warners silt loam (where drained)
Wh—Washtenaw silt loam (where drained)

use and management of the soils

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

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

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

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

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

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

crops and pasture

Darrell Brown, district conservationist, Soil Conservation Service, assisted in the preparation of this section.

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

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

In 1974 more than 223,905 acres in the survey area was cropland according to the 1974 Census of Agriculture Preliminary Report. Of this total, 199,410 acres was harvested cropland, mostly in corn, soybeans, and wheat; 16,690 acres was used for rotation hay and pasture; the remaining 7,805 acres was idle cropland and used for conservation purposes. An additional 26,000 acres was permanent pasture and about 26,000 acres was in woodland (*3*), crops, and pasture.

The potential of the soils in La Porte County for increased production of food is fair. About 12,612 acres of potentially good cropland is currently used as pasture (*3*). In addition to the reserve productive capacity represented by this land, food production could also be increased by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

The acreage in crops and pasture has gradually been decreasing as more and more land is used for urban development. In 1974 there were about 128,241 acres of urban, or built-up, land in the county; this acreage has been growing at the rate of about 500 acres per year (*3*). The use of this soil survey to help make land use decisions that will influence the future role of farming in the county is discussed in the section "General soil map units."

Drainage is the major soil problem on about 42 percent of the cropland in La Porte County. Most of the very poorly drained soils, such as Adrian, Gilford, Houghton, Edwards, and Sebewa soils, are satisfactorily drained for use in agricultural production. A few areas of these soils, however, cannot be economically drained. They are depressional, and drainage ditches to a suitable outlet would have to be deep and extend for great distances. This condition exists for some areas of Adrian, Houghton, and Edwards soils.

Some of the soils that have a high water table do not have adequate natural outlets (fig. 5). Open ditches constructed in these sandy soils are often not stable and tend to become filled with sand over a period of a few years. When these ditches are filled, the capacity of the open ditch and the drains discharging water into them is severely affected.

Figure 5.—Pumps have been used in the very poorly drained soils that are being farmed to overcome ponding. These soils do not have outlets.

Unless artificially drained, the somewhat poorly drained soils are so wet that crops are damaged during most years. In this category are the Blount, Bourbon, Fluvaquents, Morocco, and Selfridge soils, which make up about 36,420 acres.

Morley and Riddles soils have good natural drainage most of the year, but they tend to dry out slowly after rains. Small areas of wetter soils along drainageways and in swales are commonly incuded in areas of these soils, especially those that have slope of 2 to 6 percent. Artificial drainage is needed in some of these wetter soils.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface and subsurface drains is needed in most areas of the very poorly drained soils that are used for intensive row cropping. Drains have to be more closely spaced in soils that have slow permeability than in soils that are more permeable. Subsurface drainage is slow in Milford, Pewamo, and Suman soils. Finding adequate outlets for subsurface drains is difficult in many areas of Adrian, Gilford, and Houghton soils.

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 draining. Keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year minimizes the oxidation and subsidence of organic soils. Some of the organic soils have special drainage problems that should be considered. Edwards and Martisco soils are muck over marl. Placing subsurface drains is usually not considered to be feasible in these soils. Because Adrian is muck over sand, there is a possibility that this soil can be overdrained. This can lead to rapid oxidation of the organic material. Information on drainage designs for each kind of soil is available in local offices of the Soil Conservation Service.

Soil erosion by wind and water is the major soil problem on about 75 percent of the cropland and pasture in La Porte County. If the slope is more than 2 percent, water erosion is a hazard. Many of the soils are sandy or organic, so they are susceptible to wind erosion during certain times of the year.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on clayey or loamy soils, such as the Morley, Riddles, and Tracy soils. Erosion also reduces productivity on soils that tend to be droughty, such as Chelsea soils. Second, soil erosion results in sediment entering streams (fig. 6). Control of erosion minimizes the pollution of streams by sediment and improves water quality for municipal use, for recreation, and for fish and wildlife.

Erosion control practices provide surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on slopes and also provide nitrogen and improve tilth for the following crop.

Many slopes are so short and irregular that contour farming is not practical. On these soils, cropping systems that provide substantial vegetative cover are required to control erosion, unless conservation tillage is practiced. Minimizing tillage and leaving crop residue on the surface help to increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area, but are more difficult to use successfully on the eroded soils and on the soils that have a clayey surface layer, such as Blount, Morley, and Riddles soils. Conservation tillage for corn, which is common on an increasing acreage, is effective in reducing erosion on land susceptible to wind and water erosion and can be adapted to most soils in the survey area. It is most difficult to practice successfully, however, on the soils that have a clayey surface layer or soils that have severe drainage problems.

Diversions and parallel terraces that have tile outlets are used to shorten the effective length of slope and are effective in reducing sheet, rill, and gulley erosion. They are most practical on deep, well drained soils that are

Figure 6.—This Chelsea soil has had the surface removed and has been left unprotected. Sediment moves readily into ditches and streams.

highly susceptible to erosion. The benefits of terracing include a reduction in soil loss and the associated loss of fertilizer elements; a reduction in sediment problems, such as crop damage and damage to water courses; reduction of the need for grassed waterways, which take productive land out of row crops; and easier farming on the contour, which reduces the use of fuel and reduces the amount of pesticides entering water courses. Many of the Elston, Riddles, and Tracy soils are suitable for terraces, if slopes are less than about 8 percent. Soils which have a heavy, clayey subsoil are less suitable for terraces and diversions.

Because of the large number of open ditches in the county, streambank protection is a practice that is needed. This practice helps reduce sloughing of ditch banks. One means of controlling erosion of ditch banks is the establishment and maintenance of sod on the banks. This is especially needed on the sandy and organic soils. Seeding recommendations are available at the local offices of the Soil Conservation Service.

Wind erosion is a hazard on most of the organic soils, such as Adrian and Houghton soils (fig. 7), and on the sandy soils, such as Chelsea, Elston, and Tracy soils. Wind erosion can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces by proper tillage minimizes wind erosion on these soils. Windbreaks of adapted shrubs are also effective in reducing wind erosion. Sandy soils that are plowed in the fall are very susceptible to wind erosion the following spring.

Soil fertility is naturally low or moderate in most soils of the uplands and the outwash soils in the survey area. The soils on flood plains, such as Fluvaquents and Suman soils and the Maumee Variant, are neutral or mildly alkaline and are naturally higher in plant nutrients than most upland and outwash soils. The very poorly drained soils, such as Adrian, Cheektowaga, Edwards, Gilford, Houghton, Maumee, Milford, Palms, Sebewa, Warners, and Washtenaw soils, are in slight depressions and receive runoff from adjacent uplands. They normally are slightly acid or neutral.

Most upland and outwash soils are naturally very strongly acid, strongly acid, or medium acid. They usually require applications of ground limestone to raise the pH level to nearly neutral to grow a good stand of such crops as alfalfa. Available phosphorus and potash levels are naturally low in most of these soils. On all soils

Figure 7.—Palms muck soils need protection from winds when the surface cover is plowed under.

additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

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

Some of the soils used for crops in the survey area have a surface layer of loam, sandy loam, and silt loam that is dark and moderate in content of organic matter. Generally the structure of these soils is moderate to weak, and intense rainfall causes the formation of some crust on the surface. The crust in some areas is hard when dry, and impervious to water. Once a hard 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 Pewamo, Sebewa, and Suman soils are clayey to loamy. Tilth is a problem because these soils often stay wet until late in the spring. If plowed when wet, these soils tend to be very cloddy when dry, and good seedbeds are difficult to prepare. Chiseling or plowing in the fall generally results in good tilth in the spring.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Corn and soybeans are the main row crops.

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

Special crops are an important part of the economy in the survey area. A significant acreage is used for vegetables and fruits. Deep soils that have good natural drainage and that warm up early in the spring are especially well suited to many vegetables and fruits. In the survey area these are the Chelsea, Coupee, Elston, Morley, Riddles, Tracy, and Tyner soils on slope of less than 12 percent, and they total about 148,334 acres. Crops can generally be planted and harvested earlier on all these soils than on the other soils in the survey area. Grapes are the main special crop grown on Chelsea soils (fig. 8). Apples (fig. 9), apricots, peaches, pears, and plums are grown on the Chelsea, Elston, Riddles, and Tracy soils and most of the strawberries are grown on Elston, Tracy, and Tyner soils. Christmas trees also grow well on most of these soils.

When adequately drained, the muck soils and the loamy, very poorly drained soils in the county are well suited to a wide range of vegetable crops and many are suited to blueberries. Adrian, Edwards, Houghton, Martisco, Muskego, and Palms muck soils make up about 39,807 acres in the survey area. The Houghton and Newton soils are especially well suited to blueberries. Newton soils make up 2,140 acres in the survey area. Some of these very poorly drained soils are used to grow sod for lawns for housing developments and for areas requiring quick cover in construction projects.

Figure 8.—A vineyard on Chelsea soils. Grapes are among the specialty crops grown in the northern part of the county.

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

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

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension

Figure 9.—An apple orchard on Elston soils.

agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

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

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

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

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, 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. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, soybeans, wheat, oats, sorghum, and sunflower.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, lovegrass, bluegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, foxtail, goldenrod, beggartick, wheatgrass, ragweed, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, maple, black walnut, beech, poplar, wild cherry, sweetgum, apple, hawthorn, dogwood, hickory, elderberry, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, dove, pheasant, meadowlark, field sparrow, cottontail, red fox, and woodchuck.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and whitetailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines (fig. 10), and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

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

building site development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other uses (fig. 10). The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 13 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that

Figure 10.—A ditch dug for pipeline in Sebewa loam, shaly sand substratum. The high water table and the sloughing banks make the installation difficult and costly.

special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils.

Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment.

Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

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

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

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal 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.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sols*. An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalfs (*Ud*, meaning humid, plus *alfs*, from Alfisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that have an udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Adrian series

The Adrian series consists of deep, very poorly drained soils in old lake basins on outwash plains. These soils are moderately slowly permeable to moderately rapidly permeable in the organic material and rapidly permeable in the underlying sand. They formed in organic deposits that are over sands. Slope ranges from 0 to 2 percent.

Adrian soils are similar to Edwards, Houghton, Muskego, and Palms soils. Edwards soils are 16 to 50 inches of organic material over marl. Houghton soils formed in deposits of organic material that are more than 51 inches thick. Muskego soils are 16 to 51 inches of organic material over coprogenous earth. Palms soils are 16 to 50 inches of organic material over loamy mineral material.

Typical pedon of Adrian muck, drained, in a pasture, 1,860 feet west and 1,140 feet south of the northeast corner of sec. 11, T. 35 N., R. 2 W.

Oa1—0 to 8 inches; black (N 2/0) sapric material broken and rubbed, black (N 2/0) dry; less than 2 percent fiber, less than 2 percent rubbed; weak fine granular structure; friable; many very fine roots; primarily herbaceous fibers; less than 5 percent mineral material; very strongly acid; abrupt smooth boundary.

Oa2—8 to 14 inches; black (N 2/0) sapric material broken and rubbed; less than 2 percent fiber, less than 2 percent rubbed; moderate coarse prismatic structure parting to moderate medium subangular blocky; friable; fine roots; primarily herbaceous fibers; less than 5 percent mineral material; very strongly acid; gradual wavy boundary.

Oa3—14 to 25 inches; black (10YR 2/1) sapric material broken and rubbed; less than 5 percent fiber, less than 2 percent rubbed; weak coarse subangular blocky structure; friable; primarily herbaceous fibers; less than 2 percent mineral material; very strongly acid; clear wavy boundary.

Oa4—25 to 32 inches; very dark brown (10YR 2/2) sapric material broken and rubbed; about 30 percent fiber, less than 5 percent rubbed; weak coarse subangular blocky structure; friable; primarily herbaceous fibers; 2 percent mineral material; very strongly acid; abrupt wavy boundary.

IIC—32 to 60 inches; dark gray (N 4/0) sand and loamy sand; single grain; loose; slight effervescence; neutral.

The organic material is derived primarily from herbaceous plants. In some pedons it is as much as 20 percent woody material. The organic tiers have a pH range of 4.5 to 5.5 in calcium chloride. The sandy IIC horizon commonly is at a depth of 16 to 50 inches.

The surface tier typically is black (10YR 2/1 or N 2/0). The organic part of the subsurface and bottom tiers are primarily sapric material; however, some pedons have thin layers of hemic material which have a combined thickness of less than 10 inches. The organic layer immediately above the sandy IIC horizon is 10 to 40 percent mineral material in some pedons. The IIC horizon dominantly is sand, loamy sand, or gravelly loamy sand that ranges from slightly acid to moderately alkaline. Free carbonates are in some pedons. The IIC horizon is from 0 to 30 percent, by volume, coarse fragments.

Blount series

The Blount series consists of deep, somewhat poorly drained soils that are slowly permeable or moderately slowly permeable. These soils are on till plains of uplands. They formed in glacial till. Slope ranges from 0 to 3 percent.

Blount soils are similar to Selfridge soils and are adjacent to Morley, Pewamo, Riddles, and Selfridge soils in the landscape. The more sloping Morley soils are on higher lying parts of the landscape. They are adjacent to the Blount soils and do not have mottling in the upper part of the B horizon. Pewamo soils have a mollic epipedon and are in depressional areas. Riddles soils are on higher lying parts of the landscape and are adjacent to the Blount soils. Selfridge soils are sandy in the upper part of the solum.

Typical pedon of Blount silt loam, 0 to 3 percent slopes, in a cultivated field, 340 feet north and 1,180 feet west of the southeast corner of sec. 18, T. 37 N., R. 4 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common roots; 1 percent gravel; neutral; abrupt smooth boundary.

B1—9 to 13 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common roots; continuous light brownish gray (10YR 6/2) silt coatings on faces of peds; 1 percent gravel; strongly acid; clear wavy boundary.

B21t—13 to 20 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few roots; thin continuous gray (10YR 5/1) clay films on faces of peds; 1 percent gravel; neutral; gradual wavy boundary.

B22t—20 to 26 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct gray (10YR 5/1) mottles; moderate medium and coarse prismatic structure parting to strong medium subangular blocky; very firm; few roots; medium continuous dark gray (10YR 4/1) clay films on faces of peds; 1 percent gravel; neutral; gradual wavy boundary.

B23t—26 to 33 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct gray (10YR 5/1) mottles; moderate coarse prismatic structure parting to strong medium subangular blocky; very firm; few roots; thin continuous gray (10YR 6/1) clay films on faces of peds; 1 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

B3t—33 to 42 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; firm; thin discontinuous gray (5Y 6/1) clay films on faces of peds; 5 percent gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

C—42 to 60 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct gray (10YR 5/1) mottles; massive; firm; 5 percent gravel; strong effervescence; moderately alkaline.

The solum ranges from 20 to 45 inches in thickness.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. It is silt loam or loam. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is silty clay loam, clay loam, and silty clay. The B2 horizon is medium acid to very strongly acid in the upper part and medium acid to moderately alkaline in the lower part. The C horizon is silty clay loam or clay loam.

Bourbon series

The Bourbon series consists of deep, somewhat poorly drained soils that are moderately rapidly permeable. These soils are on outwash plains, valley trains, and sandy lake plains. They formed in loamy and sandy glaciofluvial deposits. Slope ranges from 0 to 2 percent.

Bourbon soils are similar to Hanna soils and are adjacent to Gilford, Pinhook, and Tracy soils in the landscape. Hanna soils have a lighter colored surface layer than the Bourbon soils. Gilford soils have a mollic epipedon, have a dominantly gray profile, and are in lower parts of the landscape. Pinhook soils have a dominantly gray profile and are in slightly lower parts of the landscape. Tracy soils have a brown subsoil that is free of mottles. They are on higher parts of the landscape and are around the Bourbon soils.

Typical pedon of Bourbon sandy loam, in a cultivated field, 600 feet east and 680 feet north of the southwest corner of sec. 27, T. 35 N., R. 3 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; moderate medium and fine granular structure; friable; common roots; 1 percent gravel; neutral; abrupt smooth boundary.

B21t—9 to 16 inches; brown (10YR 5/3) sandy loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure parting to weak fine granular; friable; common roots; thin patchy yellowish brown (10YR 5/6) clay bridges between sand grains and coatings on sand grains; 2 percent gravel; strongly acid; clear wavy boundary.

B22t—16 to 25 inches; yellowish brown (10YR 5/4) shaly sandy loam; common medium distinct light brownish gray (10YR 6/2) and dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure parting to moderate fine and medium granular; friable; few roots; thin discontinuous dark yellowish brown (10YR 4/4) clay bridges between sand grains and clay coatings on sand grains; 18 percent shale and gravel; strongly acid; gradual wavy boundary.

B23t—25 to 33 inches; light brownish gray (10YR 6/2) shaly sandy loam; common medium faint yellowish brown (10YR 5/4) mottles; weak fine and medium subangular blocky structure; very friable; thin discontinuous dark yellowish brown (10YR 4/4) clay bridges between sand grains and clay coatings on sand grains; 22 percent shale and gravel; very strongly acid; gradual wavy boundary.

B24tg—33 to 41 inches; light brownish gray (10YR 6/2) shaly sandy loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak fine and medium subangular blocky structure; friable; thin patchy yellowish brown (10YR 5/8) clay bridges between sand grains; 25 percent shale and gravel; very strongly acid; clear wavy boundary.

IIC—41 to 60 inches; grayish brown (10YR 5/2) stratified sand and shaly and gravelly sand; many medium prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/8) mottles; single grain; loose; 15 percent shale and gravel; strongly acid.

The solum ranges from 40 to 60 inches in thickness. It is from 1 to 30 percent coarse fragments.

The Ap horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or very dark brown (10YR 2/2). It is sandy loam or loamy sand. In uncultivated areas, this soil has an A1 horizon which is very dark gray (10YR 3/1) or black (10YR 2/1) sandy loam and which is slightly acid to strongly acid. The B2t horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. It is sandy loam, shaly sandy loam, or loamy sand. Some pedons have horizons of sandy clay loam less than 8 inches thick. The B2t horizon is strongly acid or very strongly acid. The IIC horizon has hue of 10YR, value of 5, and chroma of 1 to 3. It is stratified sand or coarse sand and shaly and gravelly sand. The IIC horizon is medium acid to neutral.

Brems series

The Brems series consists of deep, moderately well drained soils that are rapidly permeable. These soils are on outwash plains. They formed in acid, outwash sand. The wind has reworked the sands in some places. Slope ranges from 0 to 3 percent.

Brems soils are similar to Morocco soils and are adjacent to Chelsea, Morocco, Oakville, and Tyner soils in the landscape. Chelsea soils have bands in the lower part of the horizon and have a surface layer of sand. Morocco soils are somewhat poorly drained. Oakville and Tyner soils do not have mottles in the solum and are on higher parts of the landscape.

Typical pedon of Brems fine sand, 0 to 3 percent slopes, in a cultivated field, 1,860 feet south and 70 feet east of the northwest corner of sec. 24, T. 34 N., R. 4 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; loose; common very fine roots; 1 percent gravel; slightly acid; abrupt smooth boundary.

B21—9 to 27 inches; yellowish brown (10YR 5/4) sand; weak medium subangular blocky structure; loose; few very fine roots; 1 percent gravel; slightly acid; gradual wavy boundary.

B22—27 to 37 inches; yellowish brown (10YR 5/4) sand; moderate coarse distinct light gray (10YR 7/2) and moderate coarse prominent strong brown (7.5YR 5/8) mottles; single grain; loose; very strongly acid; gradual wavy boundary.

C1—37 to 50 inches; very pale brown (10YR 7/3) sand; single grain; loose; very strongly acid; clear wavy boundary.

C2—50 to 60 inches; brownish yellow (10YR 6/6) sand; common fine distinct very pale brown (10YR 7/3) and common coarse faint light yellowish brown (10YR 6/4) mottles; single grain; loose; very strongly acid; clear wavy boundary.

The solum ranges from 35 to 70 inches in thickness.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. It is loamy sand or fine sand. The Ap horizon ranges from slightly acid to strongly acid, depending on past liming practices. The B2 horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 8. Mottles that have chroma of 2 or less are between depths of 20 and 36 inches. The B2 horizon is loamy sand or sand. It ranges from medium acid to very strongly acid. Weakly iron-cemented sand is in the B22 horizon of some pedons. The C horizon is medium or fine sand to a depth of 60 inches or more.

Cheektowaga series

The Cheektowaga series consists of deep, very poorly drained soils on lake plains and till plains. These soils are rapidly permeable in the upper part of the solum and are slowly permeable or very slowly permeable in the lower part and in the substratum. They formed in loamy and sandy deposits that are over fine textured lacustrine deposits. Slope ranges from 0 to 2 percent.

Cheektowaga soils are similar to Maumee soils. The Maumee soils do not have the underlying clayey material that the Cheektowaga soils have.

Typical pedon of Cheektowaga fine sandy loam, in a cultivated field, 1,430 feet east and 2,060 feet north of the southwest corner of sec. 36, T. 38 N., R. 4 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common fine and medium roots; neutral; abrupt smooth boundary.

A3—8 to 13 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

B21g—13 to 16 inches; gray (5Y 6/1) fine sand; common fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; single grain; loose; few fine roots; very dark gray (10YR 3/1) linings of old root channels and krotovina; 1 percent fine gravel; neutral; clear wavy boundary.

B22g—16 to 21 inches; gray (5Y 6/1) loamy fine sand; many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure parting to single grain; very friable; 1 percent fine gravel; mildly alkaline; clear wavy boundary.

B23g—21 to 26 inches; light brownish gray (2.5Y 6/2) fine sand; common fine faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/4) mottles; single grain; loose; mildly alkaline; abrupt wavy boundary.

B24g—26 to 30 inches; dark gray (10YR 4/1) fine sandy loam; many fine distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; neutral; abrupt wavy boundary.

IIC1—30 to 36 inches; yellowish brown (10YR 5/4) silty clay; moderate medium and fine subangular blocky structure; firm; many continuous distinct thin light gray (10YR 6/1) films on faces of peds; neutral; clear wavy boundary.

IIC2—36 to 60 inches; mottled yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) silty clay; massive; firm; light gray (10YR 7/1) calcium carbonate accumulations; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to clayey material ranges from 20 to 40 inches. The sandy, upper horizons range in reaction from medium acid to mildly alkaline and the clayey material ranges from neutral to moderately alkaline.

The Ap horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. It is very fine sandy loam, fine sandy loam, or sandy loam. The B2 horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 4 or 5; and chroma of 1 or 2. It has few to many mottles that have low and high chroma. The B2 horizon is sand, fine sand, or loamy fine sand and subhorizons of fine sandy loam as much as 7 inches thick. The IIC horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 4 to 6; and chroma of 2 to 6 and common or many mottles of low and high chroma. It is silty clay, clay, or silty clay loam that is more than 35 percent clay.

Chelsea series

The Chelsea series consists of deep, excessively drained soils that are rapidly permeable. These soils are on sandy outwash plains and uplands. They formed in sandy outwash material and windblown sands. They are generally on convex summits and on side slopes. Slope ranges from 2 to 18 percent.

Chelsea soils are similar to Oakville soils and are adjacent to Brems, Morocco, Tracy, and Tyner soils in the landscape. Oakville soils do not have the thin bands in the Bt horizon above a depth of 60 inches that the

Chelsea soils do. Brems soils have mottles in the lower part of the solum and are on lower parts of the landscape. Morocco soils have a mottled subsoil and are in low lying parts of the landscape. Tracy soils have more clay in the control section and also have shale fragments in the profile. Tyner soils do not have the thin bands in the Bt horizon and have coarser sand.

Typical pedon of Chelsea fine sand, 6 to 12 percent slopes, in a wooded area, 320 feet south and 1,900 feet east of the center of sec. 24, T. 37 N., R. 4 W.

A11—0 to 3 inches; very dark gray (10YR 3/1) fine sand, grayish brown (10YR 5/2) dry; single grain; loose; many fine and very fine roots; medium acid; clear wavy boundary.

A12—3 to 7 inches; dark brown (10YR 4/3) fine sand, pale brown (10YR 6/3) dry; single grain; loose; many fine and very fine roots; strongly acid; clear wavy boundary.

A21—7 to 23 inches; dark yellowish brown (10YR 4/4) fine sand; single grain; loose; common fine and few medium roots; strongly acid; clear wavy boundary.

A22—23 to 36 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; strongly acid; clear wavy boundary.

A&B—36 to 80 inches; light yellowish brown (10YR 6/4) fine sand (A part); single grain; loose; and bands of dark brown (7.5YR 4/4) loamy sand (B part); weak medium subangular blocky structure; friable; bands are 1/4 inch to 1 1/2 inches thick and spaced 3 to 10 inches apart and have a cumulative thickness of 4 1/2 inches; clay bridges connect sand grains in the bands; strongly acid.

The solum is 48 to 72 inches in thickness.

The thickness and color of the A1 or Ap horizon range considerably because these soils are very susceptible to wind erosion, and rodent activity is intense. The Ap, A1, and A2 horizons have hue of 10YR, value of 3 to 6, and chroma of 1 to 4. These soils have an A & B horizon. The B part is lamellae 1/4 inch to 2 inches thick. It has hue of 10YR or 7.5YR, value and chroma of 3 or 4, and texture of sandy loam or loamy sand. The upper most lamallae range in depth from 27 to 46 inches, and their cumulative thickness within a depth of 60 inches is less than 6 inches.

Cohoctah series

The Cohoctah series consists of deep, very poorly drained soils that are moderately rapidly permeable. These soils are on bottom land. They formed in loamy and sandy alluvium. Slope ranges from 0 to 2 percent.

These soils are more acid in the surface horizons, have more sand in the lower part of the solum, and are more brown in the C horizon than is defined as the range for the series, but these differences do not alter the usefulness or behavior of these soils.

Cohoctah soils are similar to Gilford soils and commonly are near Gilford and Maumee soils. Gilford soils decrease regularly in content of organic matter as depth increases and have more gravel in the control section. Maumee soils are sandy.

Typical pedon of Cohoctah sandy loam, in a cultivated field, 2,460 feet south and 1,760 feet east of the northwest corner of sec. 31, T. 35 N., R. 2 W.

Ap—0 to 10 inches; black (10YR 2/1) sandy loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many fine roots; few fine horizontal worm casts; strongly acid; abrupt smooth boundary.

A12g—10 to 18 inches; black (N 2/0) sandy loam, dark gray (10YR 4/1) dry; common fine distinct brown (7.5YR 4/4) and common coarse prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common fine and very fine roots; common continuous distinct thin black (N 2/0) organic coatings in root channels and on faces of some peds; few fine vertical and horizontal worm casts; strongly acid; clear wavy boundary.

ACg—18 to 25 inches; black (10YR 2/1) loam and thin strata of grayish brown (10YR 5/2) and brown (10YR 5/3) fine sand and loamy sand; common medium distinct dark gray (10YR 4/1) mottles; weak fine and medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; thin discontinuous very dark gray (5Y 3/1) organic coatings on faces of peds; few iron concretions; neutral; clear wavy boundary.

C1—25 to 44 inches; strong brown (7.5YR 5/6) loamy sand and thin strata of sand; single grain; loose; black (10YR 2/1) vertical streaks of old root channels; common iron concretions that have sand grains adhering; slight effervescence; mildly alkaline; clear wavy boundary.

C2—44 to 60 inches; brown (7.5YR 4/4) and gray (10YR 5/1) sand and thin strata of dark gray (10YR 4/1) silt loam; single grain; loose; strong effervescence; moderately alkaline.

The A horizon, or mollic epipedon, ranges from 10 to 20 inches in thickness. The reaction of the upper part of the soil ranges from strongly acid to slightly acid. Below 30 inches it is from mildly alkaline to moderately alkaline. This soil has a high iron content throughout the profile.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2 and is loam, sandy loam, fine sandy loam, or loamy sand. The C horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 1 to 6. Very dark brown (10YR 2/2) or black (10YR 2/1) layers are present in the C horizon in some pedons. The 10- to 40-inch control section is sandy loam, fine sandy loam, or loam and has layers of sand, loamy sand, loamy fine sand, and silt loam.

Coupee series

The Coupee series consists of deep, well drained soils on outwash plains. These soils are moderately permeable in the upper part of the solum and rapidly permeable or very rapidly permeable in the lower part of the solum. They formed in glacial outwash that is loamy in the upper part and sand and gravel and shale in the lower part. Slope ranges from 0 to 6 percent.

Coupee soils are similar to Elston soils and are adjacent to Tracy and Troxel soils. The Elston soils have more sand in the upper part of the solum. Tracy soils have a thinner and lighter colored surface layer than the Coupee soils and have less clay in the upper part of the solum. Troxel soils are in potholes or depressions within areas of Coupee soils and have a dark surface layer at least 24 inches thick.

Typical pedon of Coupee silt loam, 0 to 2 percent slopes, in a cultivated field, 800 feet west and 500 feet north of the center of sec. 12, T. 36 N., R. 3 W.

Ap—0 to 10 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; medium acid; abrupt smooth boundary.

A12—10 to 13 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; medium acid; clear wavy boundary.

A3—13 to 16 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate very fine and fine subangular blocky structure; friable; thin discontinuous very dark grayish brown (10YR 3/2) organic coatings on faces of peds; medium acid; clear wavy boundary.

B21—16 to 25 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine and medium subangular blocky structure; firm; 3 percent fine shale fragments; thin discontinuous dark yellowish brown (10YR 3/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—25 to 34 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; 5 percent fine shale fragments; thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds; strongly acid; clear wavy boundary.

B23—34 to 37 inches; dark yellowish brown (10YR 4/4) sandy loam; weak coarse subangular blocky structure parting to moderate medium subangular blocky; friable; 3 percent fine shale fragments; strongly acid; abrupt wavy boundary.

IIB3—37 to 45 inches; dark yellowish brown (10YR 4/4) shaly loamy sand; single grain; loose; 20 percent fine shale fragments; very strongly acid; clear wavy boundary.

IIC—45 to 60 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; 5 percent fine shale fragments; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. Contrasting material is at a depth of 30 to 40 inches. The subsoil and substratum ranges from medium acid to very strongly acid to a depth of 60 to 70 inches. The amount of gravel and shale in the subsoil ranges from less than 5 percent in some horizons to as much as 25 percent in others.

The Ap horizon has hue of 10YR, value of 1 to 3, and chroma of 1 to 3. It is silt loam, loam, or sandy loam. When present, the A12 horizon has similar colors and textures as the Ap horizon. The A horizon has a total thickness that ranges from 10 to 18 inches. The B2t horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. It is clay loam, sandy clay loam, or loam and some pedons have subhorizons of sandy loam. The B3 horizon has similar colors to the B2t horizon and is loamy sand or sand. The IIC horizon has strata of sand and gravelly and shaly sand to a depth of 60 inches. It can have thin layers of gravelly and shaly loamy sand, loam, or sandy loam.

Edwards series

The Edwards series consists of deep, very poorly drained soils in depressions or on flats within outwash plains, till plains, and the moraine. These soils formed in organic material over marl. They are moderately slowly permeable to moderately rapidly permeable in the organic material. Permeability is variable in the marl. Slope ranges from 0 to 2 percent.

These soils are more acid and the marl layer next to the organic layer is darker than is defined as the range for the series, but this difference does not alter the usefulness or behavior of these soils.

Edwards soils are similar to Adrian, Houghton, Martisco, Muskego, and Palms soils and are also near Martisco soils. Adrian soils have organic tiers that are 16 to 50 inches thick over sand. Houghton soils have organic tiers more than 51 inches thick. Muskego soils have organic tiers that are 16 to 50 inches thick over coprogenous earth. Palms soils have organic tiers that are 16 to 50 inches thick over loamy mineral material. Martisco soils have organic tiers that are 8 to 16 inches thick over marl.

Typical pedon of Edwards muck, drained, in a cultivated field, 60 feet north and 1,920 feet west of the southeast corner of sec. 3, T. 35 N., R. 4 W.

Oa1—0 to 7 inches; black (10YR 2/1) sapric material broken and rubbed; less than 5 percent fiber, less than 2 percent rubbed; moderate fine and medium granular structure; friable; many fine fibrous roots; primarily herbaceous fibers; strongly acid; abrupt smooth boundary.

Oa2—7 to 14 inches; black (10YR 2/1) sapric material broken and rubbed; 10 percent fiber, less than 2 percent rubbed; weak thick platy structure; friable; common fine fibrous roots; yellowish red (5YR 4/8) splotches and coatings in old root channels; primarily herbaceous fibers; strongly acid; clear wavy boundary.

Oa3—14 to 22 inches; black (10YR 2/1) and very dark gray (10YR 3/1) sapric material, black (10YR 2/1) rubbed; 10 percent fiber, less than 2 percent rubbed; weak thick platy structure; friable; few fine fibrous roots; strong brown (7.5YR 5/8) splotches and coatings in old root channels; primarily herbaceous fibers; extremely acid; clear wavy boundary.

IILca1—22 to 33 inches; dark gray (10YR 4/1) marl; massive; friable; yellowish brown (10YR 5/6) marl around old root channels and strong brown (7.5YR 5/8) marl in old root channels; common white (10YR 8/1) shells; violent effervescence; moderately alkaline; clear wavy boundary.

IILca2—33 to 60 inches; gray (10YR 6/1) marl; massive; friable; yellowish brown (10YR 5/6) marl around old root channels and strong brown (7.5YR 5/8) marl in old root channels; many white (10YR 8/1) shells; violent effervescence; moderately alkaline.

The organic fibers are primarily derived from herbaceous plants. The Lca horizon ranges in depth from 16 to 49 inches. The organic material ranges in reaction from extremely acid to medium acid in 0.01m calcium chloride.

The surface tier is black (N 2/0, 10YR 2/1) or very dark brown (10YR 2/2) on broken face and rubbed. Rubbed fiber percentages are typically less than 10 percent. The organic part of the subsurface and bottom tiers is black (N 2/0 or 10YR 2/1) or very dark gray (N 3/0 or 10YR 3/1) or has hue of 5YR, 7.5YR, or 10YR; value of 2 or 3; and chroma of 2 or 3 on broken face and rubbed. The Lca horizon has hue of 10YR, value of 4 to 8, and chroma of 1 or 2. In some pedons the marl has a layer of sandy material, which is less than 12 inches thick and which is within a depth of 51 inches.

Elston series

The Elston series consists of deep, well drained soils on outwash plains. These soils are moderately rapidly permeable in the solum and very rapidly permeable in the substratum. They formed in loamy and sandy glacial outwash. Slope ranges from 0 to 6 percent.

These soils have a loamy sand texture at a depth of 26 inches and below, the clay does not increase sufficiently to qualify for an argillic horizon, and these soils are generally lower in base saturation than is defined as the range for the series. These differences, however, do not alter the usefulness or behavior of these soils.

Elston soils are similar to Coupee and Tracy soils and are adjacent to Tracy and Troxel soils. Coupee soils have more clay in the upper part of the solum. Tracy soils have a lighter colored surface layer, are more acid, and are in similar positions on the landscape. Troxel soils have a thicker surface soil, have more silt in the solum, and are in similar positions on the landscape.

Typical pedon of Elston loam, 0 to 2 percent slopes, in a cultivated field, 1,660 feet west and 860 feet north of the southeast corner of sec. 4, T. 35 N., R. 4 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common roots; 3 percent shale and gravel; medium acid; abrupt smooth boundary.

A12—10 to 15 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate medium and coarse granular structure; friable; common roots; 2 percent shale and gravel; medium acid, clear wavy boundary.

A3—15 to 19 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; friable; few discontinuous faint thin black (10YR 2/1) organic coatings on faces of peds; few fine roots; 5 percent shale and gravel; strongly acid; clear wavy boundary.

B21t—19 to 26 inches; dark yellowish brown (10YR 3/4) sandy loam; weak fine and medium subangular blocky structure; friable; few fine roots; 5 percent shale and gravel; strongly acid; clear wavy boundary.

B22t—26 to 39 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium and coarse subangular blocky structure; very friable; thin dark brown (10YR 4/3) clay bridges between and coatings on sand grains; few fine roots; 8 percent shale and gravel; strongly acid; abrupt wavy boundary.

B3—39 to 48 inches; dark yellowish brown (10YR 3/4) loamy sand; weak coarse subangular blocky structure; very friable; 10 percent shale and gravel; strongly acid; abrupt wavy boundary.

C—48 to 60 inches; brown (10YR 5/3) sand; few fine faint yellowish brown (10YR 5/4) mottles; single grain; loose; 10 percent shale and gravel; slightly acid.

The solum ranges from 42 to 72 inches in thickness. The sand throughout the solum is dominantly medium and coarser.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is loam or sandy loam. The Ap horizon ranges from neutral to strongly acid, depending on the past liming history. The B2t horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 to 5; and chroma of 3 or 4. It is loam, sandy loam, sandy clay loam, or loamy sand. The B2t horizon ranges from medium acid to very strongly acid. The B3 horizon typically has the same range in color as the B2t horizon. It is loamy sand or sand. The B3 horizon ranges from medium acid to very strongly acid. The C horizon ranges from medium acid to moderately alkaline.

Gilford series

The Gilford series consists of deep, very poorly drained soils on glacial outwash plains. Permeability is moderately rapid in the subsoil and rapid in the substratum. These soils formed in loamy and sandy glacial outwash and lacustrine sediment. Slope ranges from 0 to 2 percent.

Gilford soils are similar to Cohoctah, Maumee, Pinhook, and Sebewa soils. Bourbon and Pinhook soils are often adjacent to Gilford soils. Organic matter in the Cohoctah soils decreases irregularly with depth. Maumee soils are sandy. Sebewa soils have a subsoil of sandy clay loam and clay loam. Bourbon and Pinhook soils have a thinner dark surface layer than the Gilford soils. The Bourbon soils also have a brown, mottled subsoil.

Typical pedon of Gilford fine sandy loam, in a cultivated field, 1,600 feet north and 160 feet east of the southwest corner of sec. 5, T. 33 N., T. 3 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; weak medium and fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A3—10 to 15 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; few medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; 2 percent shale and gravel; slightly acid; clear wavy boundary.

B21g—15 to 25 inches; dark gray (10YR 4/1) sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles; firm; thin patchy very dark gray (N 3/0) clay films on faces of peds; 8 percent shale and gravel; slightly acid; gradual wavy boundary.

B22g—25 to 36 inches; dark gray (10YR 4/1) sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles; firm; thin patchy very dark gray (N 3/0) clay films on faces of peds; 8 percent shale and gravel; neutral; clear wavy boundary.

C—36 to 60 inches; pale brown (10YR 6/3) sand; many medium and coarse distinct gray (10YR 5/1) and few fine faint yellowish brown (10YR 5/4) mottles; single grain; loose; neutral.

The solum ranges from 25 to 40 inches in thickness. It is commonly slightly acid or neutral, and in some pedons it is medium acid. The solum is 0 to 8 percent, by volume, shale and gravel. The mollic epipedon ranges from 10 to 22 inches in thickness.

The A horizon has hue of 10YR, value of 2 and 3, and chroma of 1 to 3. It is fine sandy loam, loam, or sandy loam. The B2g horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. Mottles are common to few and faint to prominent. Splotches of soft, dark brown oxides of iron-manganese are common in many pedons. The B2g horizon is fine sandy loam or sandy loam. The C horizon is sand, fine sand, or loamy sand. Strata of shaly or gravelly sand are present in some pedons. The C horizon ranges from neutral to moderately alkaline.

Hanna series

The Hanna series consists of deep, moderately well drained soils on outwash plains. These soils are moderately permeable in the solum and rapidly permeable in the substratum. They formed in loamy and sandy outwash that has a fairly large amount of shale. Slope ranges from 0 to 3 percent.

Hanna soils are similar to Bourbon soils and are commonly near Quinn and Tracy soils. The Bourbon soils have a darker colored surface layer than the Hanna soils. Quinn soils have a gray subsoil. Tracy soils are in higher areas, are on slopes, and have a brown subsoil.

Typical pedon of Hanna sandy loam, 0 to 3 percent slopes, in a cultivated field, 360 feet north and 1 foot west of the center of sec. 31, T. 35 N., R. 4 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; 10 percent gravel and shale; neutral; abrupt smooth boundary.

A2—6 to 9 inches; dark brown (10YR 4/3) sandy loam, very pale brown (10YR 7/3) dry; moderate medium and coarse granular structure; friable; few fine roots; 10 percent gravel and shale; neutral; abrupt smooth boundary.

B1—9 to 13 inches; dark brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; friable; few fine roots; 5 percent gravel and shale; very strongly acid; clear wavy boundary.

B21t—13 to 18 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; few fine roots; thin patchy clay films that are on faces of peds and bridge sand grains; 5 percent gravel and shale; very strongly acid; clear wavy boundary.

B22t—18 to 26 inches; brown (10YR 5/3) loam; many fine faint light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few fine roots; thin patchy clay films that are on faces of peds and bridge sand grains; 5 percent gravel and shale; very strongly acid; clear wavy boundary.

B23t—26 to 31 inches; mottled dark yellowish brown (10YR 4/4) and light brownish gray (10YR 6/2) sandy loam; weak coarse subangular blocky structure; thin clay films that are on sand grains and bridge sand grains; friable; 15 percent gravel and shale; strongly acid; clear wavy boundary.

IIB3—31 to 65 inches; mottled yellowish brown (10YR 5/4), gray (10YR 6/1), and grayish brown (10YR 6/2) stratified loamy sand, sand, and sandy loam; single grain and massive; loose and friable; 10 percent gravel and shale; strongly acid; gradual wavy boundary.

IIC—65 to 80 inches; yellowish brown (10YR 5/4) sand; common grayish brown (10YR 5/2) mottles; single grain; loose; 5 percent gravel and shale; medium acid.

The solum ranges from 36 to 70 inches in thickness. The amount of gravel and shale ranges from less than 5 percent to 20 percent in the upper part of the solum and from 5 to 30 percent in the lower part.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. When the soil is dry, the value is 6 or 7. The Ap horizon is sandy loam or loam. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 5. It is sandy loam or loam. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, sandy loam, or shaly and gravelly sandy loam. The B2t horizon is strongly acid or very strongly acid. The C horizon is sand, shaly and gravelly sand, sandy clay loam, and loam. It is medium acid or strongly acid.

Homer series

The Homer series consists of deep, somewhat poorly drained soils on terraces, lake plains, and outwash plains. These soils are moderately permeable in the solum and very rapidly permeable in the substratum. They formed in stratified loamy sediment. Slope ranges from 0 to 2 percent.

These soils have a transitional sandy layer too thick to qualify as contrasting textures. In addition, the soils have a higher pH value in the solum than is defined as the range for the series and have carbonates at a depth of less than 30 inches. These differences, however, do not alter the usefulness or behavior of the soil.

Homer soils are adjacent to Pewamo and Riddles soils in the landscape. Pewamo soils have a mollic epipedon and are in depressional areas. Riddles soils have a brown subsoil and are on higher positions in the landscape.

Typical pedon of Homer loam, in a cultivated field, 860 feet south and 2,480 feet east of the northwest corner of sec. 21, T. 37 N., R. 4 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

B21t—10 to 15 inches; grayish brown (10YR 5/2) clay loam; many medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; neutral; clear wavy boundary.

B22t—15 to 22 inches; brown (10YR 5/3) clay loam; many medium distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin continuous dark grayish brown (10YR 4/2) clay films on faces of peds; neutral; clear wavy boundary.

IIB3—22 to 34 inches; grayish brown (10YR 5/2) fine sandy loam; common medium distinct yellowish brown (10YR 5/6) and common medium faint brown (10YR 5/3) and gray (10YR 5/1) mottles; weak coarse subangular blocky structure; friable; 3 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

IIC1—34 to 40 inches; mottled yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) stratified loamy sand and sand; massive; very friable; 3 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

IIC2—40 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; 4 percent gravel; slight effervescence; mildly alkaline.

The solum ranges from 28 to 36 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. It is loam, silt loam, fine sandy loam, or sandy loam. The Ap horizon is slightly acid or neutral. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is clay loam, loam, sandy clay loam, silty clay loam, or fine sandy loam. The B2 horizon ranges from slightly acid to mildly alkaline. The B3 horizon is mildly alkaline or moderately alkaline. The C horizon is stratified loamy sand, sand, sandy clay loam, and loam. It is mildly alkaline or moderately alkaline.

Houghton series

The Houghton series consists of deep, very poorly drained soils that are moderately slowly permeable to moderately rapidly permeable. These soils are in bogs within lake plains, outwash plains, till plains, and moraines. They formed in deep, herbaceous organic deposits. Slope ranges from 0 to 2 percent.

Houghton soils are similar to Adrian, Edwards, Muskego, and Palms soils. All of these soils have an organic tier 16 to 50 inches thick. Adrian soils are over sand. Edwards soils are over marl. Muskego soils are over coprogenous earth. Palms soils are over loamy mineral material.

Typical pedon of Houghton muck, drained, in a cultivated field, 2,160 feet south and 240 feet west of the northeast corner of sec. 25, T. 35 N., R. 2 W.

Oa1—0 to 9 inches; black (N 2/0) sapric material, black (10YR 2/1) rubbed; less than 5 percent fiber, less than 2 percent rubbed; weak medium granular structure; friable; common fine roots; primarily herbaceous fibers; strongly acid; abrupt smooth boundary.

Oa2—9 to 19 inches; black (10YR 2/1) sapric material, broken and rubbed; 5 percent fiber, less than 2 percent rubbed; weak coarse subangular blocky structure; friable; common fine roots; primarily herbaceous fibers; strongly acid; clear wavy boundary.

Oa3—19 to 25 inches; black (10YR 2/1) sapric material, very dark gray (10YR 3/1) rubbed; 25 percent fiber, less than 2 percent rubbed; massive; friable; primarily herbaceous fibers; strongly acid; clear wavy boundary.

Oa4—25 to 38 inches; very dark brown (10YR 2/2) sapric material turns black (10YR 2/1) almost immediately after breaking, very dark gray (10YR 3/1) rubbed; 50 percent fiber, 5 percent rubbed; massive; friable; primarily herbaceous fibers; strongly acid; clear wavy boundary.

Oa5—38 to 70 inches; very dark grayish brown (10YR 3/2) sapric material, black (10YR 2/1) rubbed; 60 percent fiber, 5 percent rubbed; massive; friable; primarily herbaceous fibers; strongly acid.

The organic tier is more than 51 inches thick. The organic material is primarily herbaceous. Tiers within the control section are black (N 2/0, 10YR 2/1, 5YR 2/1) or very dark gray (N 3/0, 10YR 3/1, 5YR 3/1) or have hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 2 or 3. Colors of broken faces become darker on brief exposure to air. The layers in the subsurface tier range from strongly acid to neutral.

Martisco series

The Martisco series consists of deep, very poorly drained soils in depressions of outwash plains, flood plains, and uplands. These soils are moderately permeable or moderately rapidly permeable in the organic material and slowly permeable in the underlying marl. They formed in organic deposits over marl. Slope ranges from 0 to 2 percent.

Martisco soils are similar to Edwards and Warners soils. Edwards soils have an organic tier that is 16 to 50 inches thick over marl. Warners soils have a mineral surface layer over marl.

Typical pedon of Martisco muck, drained, in a cultivated field, 1,000 feet north and 460 feet west of the center of sec. 29, T. 36 N., R. 2 W.

Oap—0 to 9 inches; black (N 2/0) sapric material; moderate fine and medium granular structure; very friable; common fine roots; less than 5 percent mineral material; few shells on surface; strong effervescence; moderately alkaline; abrupt smooth boundary.

IILca1—9 to 20 inches; dark gray (5Y 5/1) marl; massive; friable; common random yellowish brown (10YR 5/4) stains around old root channels; common random black (10YR 2/1) and very dark brown (10YR 2/2) decayed roots; many fine prominent white (10YR 8/1) decayed shells; strong effervescence; moderately alkaline; abrupt smooth boundary.

IILca2—20 to 29 inches; grayish brown (2.5Y 5/2) marl; massive; friable; common random yellowish brown (10YR 5/6) stains around old root channels; common vertical black (10YR 2/1) and very dark brown (10YR 2/2) decayed roots; common fine prominent white (10YR 8/1) decayed shells; strong effervescence; moderately alkaline; clear wavy boundary.

IILca3—29 to 60 inches; gray (5Y 5/1) marl; massive; friable; common random yellowish brown (10YR 5/6) stains around old root channels; common vertical very dark brown (10YR 2/2) decayed roots; common medium and coarse light gray (10YR 7/1) carbonates; common fine prominent white (10YR 8/1) decayed shells; strong effervescence; moderately alkaline.

The organic tier ranges from 8 to 16 inches in thickness.

The Oa horizon, or Ap horizon, is black (N 2/0, 10YR 2/1, 5YR 2/1) or has hue of 5YR, 7.5YR, or 10YR; value of 2; and chroma of 2. It ranges from slightly acid to moderately alkaline. Content of mineral material ranges from none to 80 percent and is dominantly silt, very fine sand, or fine sand. Typically, the Oa horizon is continuous vertically, but in some pedons there are alternating, thin strata of organic material and marl. The C horizon is gray (N 5/0, 6/0) or light gray (N 7/0) or has hue of 10YR, 2.5Y, or 5Y; value of 5 to 8; and chroma of 1 or 2 with or without mottles. The IIC horizon is below a depth of 32 inches in some pedons. It ranges from silty clay to fine sandy loam. A layer, 1 to 6 inches thick, of coprogenous earth is in some pedons.

Maumee series

The Maumee series consists of deep, very poorly drained soils that are rapidly permeable. These soils are on outwash plains and lake plains. They formed in sandy sediments. Slope ranges from 0 to 2 percent.

Maumee soils are similar to Cheektowaga, Gilford, and Newton soils and the Maumee Variant. Cheektowaga soils are underlain by clayey material at a depth of 20 to 40 inches. Gilford soils have more clay and silt in the control section. The organic matter in the Maumee Variant decreases erratically with depth. Shells are throughout the profile. Newton soils are more acid than the Maumee soils.

Typical pedon of Maumee loamy fine sand, in a cultivated field, 540 feet west and 200 feet south of the northeast corner of sec. 29, T. 34 N., R. 3 W.

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

A12—10 to 18 inches; very dark gray (10YR 3/1) loamy fine sand, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; very friable; common fine roots; common black (10YR 2/1) organic stains in old root channels; common light brownish gray (10YR 6/2) uncoated sand grains; slightly acid; clear wavy boundary.

C1—18 to 28 inches; dark gray (10YR 4/1) sand; few fine faint dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; very friable; common black (10YR 2/1) organic stains in old root channels; common light brownish gray (10YR 6/2) uncoated sand grains; slightly acid; clear wavy boundary.

C2—28 to 50 inches; light brownish gray (10YR 6/2) sand; common medium distinct light yellowish brown (10YR 6/4) mottles; single grain; loose; neutral; clear wavy boundary.

C3—50 to 60 inches; light brownish gray (10YR 6/2) coarse sand; few fine distinct light yellowish brown (10YR 6/4) mottles; single grain; loose; neutral.

The mollic epipedon ranges from 14 to 24 inches in thickness. The upper 40 inches is generally slightly acid or neutral.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2 or is black (N 2/0). It is loamy fine sand but includes some fine sandy loam or sand. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2 to a depth of about 40 inches. It is mottled and commonly has thin, horizontal bands or vertical fillings of darker colored material in old root zones or crayfish holes. It is sand or loamy fine sand and thin subhorizons that are fine sandy loam or sandy loam. The C horizon is neutral or mildly alkaline below a depth of 40 inches.

Maumee Variant

The Maumee Variant consists of deep, very poorly drained, soils that are moderately rapidly permeable to very rapidly permeable. These soils are on outwash plains. They formed in stratified sediment. Slope ranges from 0 to 2 percent.

The Maumee loamy sand Variant is similar to Maumee soils. The organic matter in the Maumee soils decreases regularly with depth.

Typical pedon of Maumee variant loamy sand, in a cultivated field, 500 feet west and 1,880 feet north of the southeast corner of sec. 14, T. 35 N., R. 2 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; very friable; many shells; strong effervescence; moderately alkaline; abrupt smooth boundary.

ACg—8 to 12 inches; grayish brown (10YR 5/2) sand; many medium faint gray (10YR 6/1) mottles; single grain; loose; many shells; dark yellowish brown (10YR 4/4) soft iron segregations; thin tongues of very dark gray (10YR 3/1); strong effervescence; moderately alkaline; clear wavy boundary.

C1g—12 to 20 inches; dark grayish brown (10YR 4/2) sand; many medium distinct gray (10YR 6/1) and many medium faint grayish brown (10YR 5/2) mottles; single grain; loose; many shells; strong effervescence; moderately alkaline; clear wavy boundary.

C2—20 to 35 inches; brown (10YR 5/3) sand; common medium distinct dark gray (10YR 4/1) and light brownish gray (10YR 6/2) mottles; single grain; loose; black (10YR 2/1) organic splotches; strong brown (7.5YR 5/6) iron segregations; many shells; strong effervescence; moderately alkaline; clear wavy boundary.

C3—35 to 45 inches; brown (10YR 5/3) sand; common medium distinct dark gray (10YR 4/1) mottles; single grain; loose; 2-inch band of black (10YR 2/1) sapric material (Oa); massive; friable; many shells; yellowish brown (10YR 5/8) soft iron segregations; strong effervescence; moderately alkaline; clear wavy boundary.

C4—45 to 60 inches; mottled gray (10YR 5/1), yellowish brown (10YR 5/6) and reddish brown (5YR 4/4) sand; single grain; loose; bands of very dark gray (10YR 3/1) organic matter, bands are 1/8 to 1/4 inch thick; many partially decomposed shells; strong effervescence; moderately alkaline.

The dark surface layer is 7 to 10 inches thick. The upper 40 inches is neutral to moderately alkaline. In most areas shells are present.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2 or is black (N 2/0). It is dominantly loamy sand and less commonly sandy loam or sand. The ACg horizon has hue of 10YR, value of 3 to 6, and chroma of 1 to 4. The C horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 to 6; and chroma of 1 to 3. The C horizon is mottled. Organic layers are throughout the C horizon. Their cumulative thickness ranges from 2 to 10 inches.

Milford series

The Milford series consists of deep, poorly drained soils that are moderately slowly permeable. These soils are on glacial lakebeds. They formed in lacustrine material. Slope ranges from 0 to 2 percent.

Milford soils are similar to Pewamo soils and are commonly adjacent to Blount and Homer soils. Pewamo soils are in morainic areas and have pebbles throughout the solum. Blount and Homer soils have a lighter colored surface layer and a brighter colored B horizon.

Typical pedon of Milford silty clay loam, in a cultivated field, 1,440 feet north and 480 feet east of the southwest corner of sec. 18, T. 37 N., R. 4 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure parting to moderate medium granular; friable; common roots; medium acid; abrupt smooth boundary.

A12—9 to 17 inches; very dark gray (N 3/0) silty clay loam, dark gray (N 4/0) dry; few fine faint olive brown (2.5Y 4/4) and dark yellowish brown (10YR 4/4) mottles; moderate medium and coarse subangular blocky structure; firm; few roots; slightly acid; clear wavy boundary.

B1g—17 to 22 inches; gray (5Y 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; strong medium prismatic structure; very firm; thin continuous dark gray (N 4/0) clay films on faces of peds; few roots; slightly acid; clear wavy boundary.

B21g—22 to 31 inches; gray (N 6/0) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; strong medium and coarse prismatic structure; very firm; thin patchy gray (5Y 5/1) clay films on faces of peds; few roots; neutral; gradual wavy boundary.

B22g—31 to 38 inches; gray (5Y 6/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; firm; thin patchy dark gray (N 4/0) clay films on faces of peds; very few roots; neutral; gradual wavy boundary.

C1—38 to 50 inches; mottled gray (5Y 6/1) and olive brown (2.5Y 4/4) stratified silty clay loam and sandy clay loam; massive; firm; slight effervescence; mildly alkaline; gradual wavy boundary.

C2—50 to 60 inches; mottled gray (N 5/0), olive brown (2.5Y 4/4) and brown (10YR 5/3) stratified silt, clay, and sandy loam; massive; friable; strong effervescence; moderately alkaline.

The solum ranges from 36 to 50 inches in thickness. The mollic epipedon ranges from 12 to 18 inches in thickness.

The A1 or Ap horizon is black (N 2/0, 10YR 2/1, or 5Y 2/1) or very dark gray (N 3/0, 10YR 3/1, or 5Y 3/1). It is silty clay loam or silty clay. The A1 or Ap horizon is slightly acid or medium acid. The B horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2 or has hue of N and value of 4 to 6. Mottles are primarily common or many and distinct or prominent. The B horizon is silty clay loam or silty clay. The C horizon is stratified, lakebed or water-sorted sediment, which is predominantly silty clay loam or clay loam and thin layers of sandy clay loam, sandy loam, silt loam, loam, and silty clay.

Morley series

The Morley series consists of deep, well drained and moderately well drained soils that are moderately slowly permeable. These soils are on uplands. They formed in calcareous, moderately fine glacial till. Slope ranges from 2 to 18 percent.

Morley soils are similar to Riddles soils and are often adjacent to Blount and Pewamo soils. Riddles soils have more sand and less clay throughout the profile. Blount soils have mottles of low chroma in the upper part of the subsoil and are on level or slightly convex flats. Pewamo soils have a mollic epipedon and are in depressional areas.

Typical pedon of Morley silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 180 feet south and 390 feet east of the northwest corner of sec. 11, T. 37 N., R. 4 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many roots; specks of yellowish brown (10YR 5/4) silty clay loam; neutral; abrupt smooth boundary.

B21t—8 to 11 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; firm; common roots; pale brown (10YR 6/3), light gray (10YR 7/2) dry silt coatings on faces of peds; thin discontinuous yellowish brown (10YR 5/6) clay films on faces of peds; neutral; clear wavy boundary.

B22t—11 to 15 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine and medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common roots; thin discontinuous brown (10YR 5/3) clay films on faces of peds; medium acid; clear wavy boundary.

B23t—15 to 22 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) silty clay loam; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; firm; few roots; thin continuous dark brown (10YR 4/3) clay films on faces of peds; slightly acid; gradual wavy boundary.

B24t—22 to 29 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct gray (10YR 6/1) and light brownish gray (10YR 6/2) and few fine prominent strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate coarse subangular blocky; firm; very few roots; many thin continuous dark brown (10YR 4/3) clay films on faces of peds; neutral; abrupt smooth boundary.

B3t—29 to 34 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct gray (10YR 6/1) and light brownish gray (10YR 6/2) and few fine prominent strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; very few roots; thin discontinuous brown (10YR 5/3) clay films on faces of peds; strong effervescence; moderately alkaline; gradual wavy boundary.

C—34 to 60 inches; pale brown (10YR 6/3) silty clay loam; few fine and medium distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; massive; very firm; threads of white (10YR 8/1) carbonate accumulations; violent effervescence; moderately alkaline.

The solum ranges from 20 to 48 inches in thickness.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Undisturbed areas have an A1 horizon less than 5 inches thick. It has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an A2 horizon that has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. The B2t horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam, silty clay loam, or silty clay that is 35 to 45 percent clay. The B2t horizon is strongly acid to neutral in the upper part and ranges from neutral to moderately alkaline in the lower part. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6 and is silty clay loam or clay loam.

Morocco series

The Morocco series consists of deep, somewhat poorly drained soils that are rapidly permeable. These soils are on outwash plains. They formed in outwash sands. Slope ranges from 0 to 2 percent.

Morocco soils are similar to Brems and Pipestone soils and are associated with Brems and Chelsea soils. Brems soils have mottles in the lower part of the subsoil and are on slightly higher parts of the landscape. Chelsea soils have a brown subsoil that has loamy sand bands and are on higher positions in the landscape. Pipestone soils have a spodic horizon.

Typical pedon of Morocco loamy fine sand, in a cultivated field, 1,000 feet north and 1,000 feet east of the center of sec. 5, T. 33 N., R. 3 W.

A1—0 to 6 inches; very dark gray (10YR 3/1) loamy fine sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

A2—6 to 14 inches; yellowish brown (10YR 5/4) loamy fine sand, light gray (10YR 7/2) dry; few fine faint brown (10YR 5/3) mottles; weak thick platy structure parting to weak fine granular; very friable; few roots; very strongly acid; clear wavy boundary.

B21—14 to 28 inches; yellowish brown (10YR 5/4) loamy fine sand; many fine and medium distinct light brownish gray (10YR 6/2) and many medium and coarse distinct strong brown (7.5YR 5/6) mottles; weak fine and medium subangular blocky structure; friable; 2 percent shale and gravel; very strongly acid; clear wavy boundary.

B22—28 to 37 inches; pale brown (10YR 6/3) fine sand; few fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; very strongly acid; gradual wavy boundary.

B3—37 to 47 inches; very pale brown (10YR 7/3) fine sand; common fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; very strongly acid; gradual wavy boundary.

C1—47 to 57 inches; brown (10YR 5/3) sand; common fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; 2 percent shale and gravel; very strongly acid; gradual wavy boundary.

C2—57 to 60 inches; pale brown (10YR 6/3) sand; single grain; loose; 8 percent fine shale and gravel; very strongly acid.

The solum ranges from 24 to 48 inches in thickness.

The A1 or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loamy fine sand, fine sand, loamy sand, or sand. The A1 or Ap horizon ranges from slightly acid to very strongly acid. When present, the A2 horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is loamy fine sand, fine sand, loamy sand, or sand. The B horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 8. It is loamy fine sand, fine sand, loamy sand, or sand. The B horizon ranges from medium acid to very strongly acid. The C horizon is fine sand or sand. It ranges from medium acid to very strongly acid.

Muskego series

The Muskego series consists of deep, very poorly drained soils that are moderately slowly permeable to moderately rapidly permeable in the organic layer and slowly permeable in the coprogenous earth. These soils are in old glacial lake basins and stream bottoms. They formed in organic deposits over coprogenous earth. Slope ranges from 0 to 2 percent.

Muskego soils are similar to Adrian, Edwards, Houghton, and Palms soils. The Adrian soil has an organic layer that is 16 to 50 inches thick over sand. The Edwards soil has an organic layer that is 16 to 50 inches thick over marl. The Houghton soil has an organic layer more than 51 inches thick. The Palms soil has an organic layer that is 16 to 50 inches thick over loamy mineral material.

Typical pedon of Muskego muck, drained, in a cultivated field, 1,980 feet west and 1,320 feet north of the southeast corner of sec. 32, T. 35 N., R. 3 W.

Oap—0 to 10 inches; black (10YR 2/1) sapric material broken and rubbed, black (10YR 2/1) dry; less than 5 percent fiber, less than 1 percent rubbed; weak fine granular structure; very friable; many fine roots; primarily herbaceous fibers; 20 percent mineral material; very strongly acid; abrupt smooth boundary.

Oe—10 to 16 inches; reddish brown (5YR 4/3) hemic material, dark reddish brown (5YR 3/3) pressed, reddish brown (5YR 3/2) rubbed; about 80 percent fiber, 20 percent rubbed; moderate thick platy structure; friable; common fine roots; primarily herbaceous fibers; less than 5 percent mineral material; medium acid; abrupt smooth boundary.

Lco1—16 to 23 inches; very dark gray (10YR 3/1) coprogenous earth, very dark grayish brown (10YR 3/2) rubbed; about 10 percent fiber, 2 percent rubbed; weak thick platy structure; firm; few fine roots; neutral; abrupt smooth boundary.

Lco2—23 to 25 inches; dark brown (10YR 3/3) coprogenous earth, broken and rubbed; about 5 percent fiber, 1 percent rubbed; moderate thin platy structure; firm; soft smooth; many soft coarse strong brown (7.5YR 5/8) iron blotches; many very fine brown to black oblong seed pods; neutral; abrupt smooth boundary.

Lco3—25 to 29 inches; dark gray (5Y 4/1) coprogenous earth; about 5 percent fiber, 1 percent rubbed; weak thin platy structure; firm; soft smooth nonplastic; many soft coarse yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) iron blotches; many white (10YR 8/1) thread-like carbonate accumulations; many very fine brown to black oblong seed pods; strong effervescence; moderately alkaline; clear smooth boundary.

Lco4—29 to 35 inches; dark gray (5Y 4/1) coprogenous earth, broken and rubbed; less than 5 percent fiber, less than 1 percent rubbed; weak thick platy structure; firm; rubbery, rebounds upon applying pressure; few soft strong brown (7.5YR 5/8) iron blotches along old root channels; many thread-like carbonate accumulations; many very fine brown to black oblong seed pods; violent effervescence; moderately alkaline; gradual wavy boundary.

Lco5—35 to 78 inches; dark gray (5Y 4/1) coprogenous earth, broken and rubbed; less than 5 percent fiber, less than 1 percent rubbed; massive; firm; nonplastic; slight rebound from applied pressure; many white (10YR 8/1) thread-like carbonate accumulations; many very fine brown to black oblong seed pods; violent effervescence; moderately alkaline; diffused boundary.

Lca—78 to 80 inches; gray (5Y 5/1) marl; less than 1 percent fiber, less than 1 percent rubbed; massive; slightly sticky; violent effervescence; moderately alkaline.

The coprogenous earth dominantly ranges from 16 to 30 inches, but in some pedons it is as much as 50 inches deep. The fiber is derived primarily from herbaceous plants. The sapric material below the surface tier ranges from medium acid to mildly alkaline.

The surface tier is black (10YR 2/1) or very dark brown (10YR 2/2) sapric material. Some pedons grade to hemic material. The organic part of the subsurface tier is black (N 2/0, 10YR 2/1, 7.5YR 2/1) or very dark gray (N 3/0, 10YR 3/1, 7.5YR 3/1). It has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 2 or 3. It is dominantly sapric material, but hemic material can total as much as 40 percent. The Lco layer has hue of 10YR, 2.5Y, or 5Y; value of 3 to 5; and chroma of 1 to 3.

Newton series

The Newton series consists of deep, very poorly drained soils that are rapidly permeable. These soils are on nearly level flats or in depressions. They formed in strongly acid sandy sediment. Slope ranges from 0 to 2 percent.

These soils do not have mottles within the lower part of the umbric epipedon or have higher chroma mottles in the horizons immediately below the umbric epipedon as is required for the series. These differences do not alter the usefulness or behavior of these soils.

Newton soils are similar to Maumee soils and are adjacent to Chelsea soils. Chelsea soils have a yellowish brown subsoil that has thin bands in the Bt horizon. These thin bands total less than 6 inches in thickness. It is on higher positions in the landscape. Maumee soils have a thicker surface soil and are less acid.

Typical pedon of Newton loamy fine sand, in a cultivated field, 1,820 feet east and 300 feet north of the southwest corner of sec. 6, T. 37 N., R. 4 W.

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

A12—10 to 15 inches; very dark gray (10YR 3/1) loamy fine sand; gray (10YR 5/1) dry; weak fine and medium granular structure; very friable; many fine roots; light brownish gray (10YR 6/2) uncoated sand grains; strongly acid; clear wavy boundary.

C1—15 to 27 inches; light brownish gray (10YR 6/2) fine sand; many coarse faint light gray (10YR 7/2) mottles; single grain; loose; strongly acid; abrupt smooth boundary.

C2—27 to 31 inches; light gray (10YR 7/2) fine sand; single grain; loose; bands of grayish brown (10YR 5/2) fine sand; strongly acid; clear wavy boundary.

C3—31 to 36 inches; gray (10YR 6/1) fine sand; many medium distinct brownish yellow (10YR 6/6) mottles; massive; very friable; strongly acid; clear wavy boundary.

C4—36 to 42 inches; gray (10YR 6/1) fine sand; few medium distinct brownish yellow (10YR 6/6) mottles; massive; very friable; pockets of light gray (10YR 7/2) uncoated sand grains; strongly acid; clear wavy boundary.

C5—42 to 56 inches; gray (10YR 5/1) loamy fine sand; massive; very friable; strong brown (7.5YR 5/6) fillings in old root channels; pockets of light gray (10YR 7/2) uncoated sand grains; 2 percent fine gravel; strongly acid; clear wavy boundary.

C6—56 to 60 inches; gray (10YR 6/1) fine sand; single grain; loose; medium acid.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loamy fine sand, fine sand, or sand. The A horizon is medium acid or strongly acid. The

C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. Mottling is present. The C horizon is strongly acid or very strongly acid to a depth of 40 inches or more. Below this it ranges to medium acid.

Oakville series

The Oakville series consists of deep, well drained soils that are very rapidly permeable. These soils are on outwash plains, low sand dunes, and beach ridges. They formed in fine sands. Slope ranges from 4 to 25 percent.

Oakville soils are similar to Chelsea and Tyner soils and are commonly adjacent to Morocco and Newton soils. Morocco soils have mottles that have chroma of 2 or less within a depth of 40 inches. Chelsea soils have a thin banded Bt horizon above a depth of 60 inches. Tyner soils have more silt and clay in the control section. Newton soils have a dark surface layer and are very strongly acid.

Typical pedon of Oakville fine sand, 12 to 25 percent slopes, in a wooded area, 2,620 feet east and 1,900 feet north of the southwest corner of sec. 12, T. 38 N., R. 4 W.

A1—0 to 4 inches; black (10YR 2/1) fine sand, very dark gray (10YR 3/1) dry; single grain; loose; many roots; neutral; abrupt wavy boundary.

A2—4 to 14 inches; dark grayish brown (10YR 4/2) fine sand and very dark gray (10YR 3/2) organic matter; single grain; loose; many roots; neutral; clear wavy boundary.

B2—14 to 39 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; common roots; neutral; gradual wavy boundary.

C—39 to 60 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; few roots; neutral.

The solum ranges from 18 to 40 inches in thickness. The solum and substratum range in reaction from medium acid to neutral.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 4 and is loamy fine sand or fine sand. In undisturbed areas an A2 horizon can be as much as 10 inches thick. It has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is fine sand or sand. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4. It is fine sand or sand.

Palms series

The Palms series consists of deep, very poorly drained soils, which are moderately slowly permeable to moderately rapidly permeable in the organic tiers and moderately permeable or moderately slowly permeable in the loamy material. These soils are on lake plains, till plains, or moraines in basins that were lakes or ponds. They formed in deposits of organic material and in the underlying, loamy mineral material. Slope ranges from 0 to 2 percent.

Palms soils are similar to Adrian, Edwards, Houghton, and Muskego soils and are often adjacent to Riddles and Tracy soils. The Adrian soil has 16 to 50 inches of organic material over sand. The Edwards soil has 16 to 50 inches of organic material over marl. The Houghton soil has organic deposits that are 51 inches thick. The Muskego soil has 12 to 51 inches of organic material over limnic material. The Riddles soil and the Tracy soil are mineral soils and are on slopes adjacent to the depressional areas of Palms soils.

Typical pedon of Palms muck, sandy substratum, in a cultivated field, 1,900 feet east and 1,100 feet south of the northwest corner of sec. 31, T. 35 N., R. 4 W.

Oa1—0 to 10 inches; black (10YR 2/1) sapric material broken and rubbed; less than 5 percent fiber, less than 2 percent rubbed; moderate medium granular structure; friable; many fibrous roots; primarily herbaceous fibers; very strongly acid; abrupt smooth boundary.

Oa2—10 to 24 inches; black (10YR 2/1) sapric material broken and rubbed; about 20 percent fiber, less than 5 percent rubbed; weak medium subangular blocky structure; friable; common fibrous roots; primarily herbaceous fibers; very strongly acid; abrupt wavy boundary.

IIC1—24 to 30 inches; dark grayish brown (10YR 4/2) loam; common medium distinct yellowish brown (10YR 5/6) and common medium faint dark gray (10YR 4/1) mottles; massive; friable; common strong brown (7.5YR 5/6) iron accumulations; 10 percent shale and gravel; slightly acid; clear wavy boundary.

IIC2—30 to 38 inches; mottled dark gray (10YR 4/1) and grayish brown (10YR 5/2) loam; massive; firm; common strong brown (7.5YR 5/6) iron accumulations; 13 percent shale and gravel; neutral; clear wavy boundary.

IIC3—38 to 44 inches; dark gray (10YR 4/1) loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; 5 percent shale and gravel; neutral; clear wavy boundary.

IIC4—44 to 49 inches; dark grayish brown (10YR 4/2) sandy loam; common medium faint dark gray (10YR 4/1) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; 3 percent shale and gravel; neutral; clear wavy boundary.

IIC5—49 to 54 inches; grayish brown (10YR 5/2) sandy loam; common medium distinct dark gray (10YR 4/1) and strong brown (7.5YR 5/6) mottles; massive; firm; 2 percent shale and gravel; slight effervescence; mildly alkaline; clear wavy boundary.

IIC6—54 to 60 inches; gray (10YR 5/1) sand; single grain; loose; slight effervescence; mildly alkaline.

The loamy IIC horizon ranges in depth from 16 to 50 inches. The fiber primarily is derived from herbaceous plants.

The surface tier has hue of 10YR, value of 2, and chroma of 1 or 2. It is very strongly acid or strongly acid. It is sapric material, but in some pedons it has both sapric and hemic material in varying proportions. The organic part of the subsurface and bottom tiers has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 1 to 3. It is extremely acid or very strongly acid. The IICg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It ranges from fine sandy loam to clay loam. The IICg horizon is sand or loamy sand below a depth of 54 inches. It ranges from very strongly acid to moderately alkaline.

Pewamo series

The Pewamo series consists of deep, very poorly drained soils that are moderately slowly permeable. These soils are in depressional areas of till and lake plains and moraines. They formed in clayey glacial till or in lacustrine sediment. Slope ranges from 0 to 2 percent.

Pewamo soils are similar to Milford soils and are commonly adjacent to Blount and Morley soils. Milford soils formed in lacustrine material and do not have till pebbles. Blount soils have a brown subsoil that has gray mottles. They are nearly level and on slightly higher parts of the landscape. Morley soils have a brown subsoil and are on the surrounding slopes.

Typical pedon of Pewamo silty clay loam, in an abandoned field, 260 feet east and 1,740 feet north of the southwest corner of sec. 8, T. 37 N., R. 4 W.

A1—0 to 10 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; moderate fine and medium subangular blocky structure; firm; many roots; 2 percent fine gravel; slightly acid; clear wavy boundary.

B21tg—10 to 17 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; strong medium and coarse subangular blocky structure; firm; common roots; medium and thick discontinuous black (N 2/0) clay and organic films on faces of peds; 2 percent fine gravel; neutral; clear wavy boundary.

B22tg—17 to 22 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; common roots; medium discontinuous very dark gray (N 3/0) clay films on faces of peds; neutral; clear wavy boundary.

B23tg—22 to 30 inches; grayish brown (10YR 5/2) clay loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; few roots; medium discontinuous gray (N 5/0) clay films on faces of peds; 4 percent fine gravel; neutral; clear wavy boundary.

B3tg—30 to 39 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct pale olive (5Y 6/4) mottles; weak medium subangular blocky structure; firm; few roots; thin discontinuous gray (10YR 5/1) clay films on faces of peds; 5 percent fine gravel; strong effervescence; moderately alkaline; gradual wavy boundary.

C—39 to 60 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; 5 percent fine gravel; strong effervescence; moderately alkaline.

The solum ranges from 28 to 45 inches in thickness. The mollic epipedon ranges from 10 to 14 inches in thickness.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is clay loam or silty clay loam. The Ap horizon is slightly acid or neutral. The B2t horizon has hue of 2.5Y, 5Y, or 10YR; value of 4 to 6; and chroma of 1 or 2. It ranges from slightly acid to mildly alkaline. The C horizon is clay loam or silty clay loam. It is neutral to moderately alkaline.

Pinhook series

The Pinhook series consists of deep, poorly drained soils on outwash plains. These soils are moderately permeable in the solum and rapidly permeable in the substratum. They formed in shaly glacial outwash sediment. They are generally on broad flats. Slope ranges from 0 to 2 percent.

Pinhook soils are similar to Gilford and Quinn soils and are often adjacent to Coupee, Hanna, and Tracy soils. Gilford soils have a mollic epipedon, have a slightly acid to neutral solum, and are on slightly lower parts of the landscape. Quinn soils do not have the dark surface horizon. Coupee soils have a brown subsoil and have more clay in the upper part of the subsoil. Hanna soils have a lighter colored surface horizon and have a dominantly brown subsoil. Tracy soils have a brown subsoil and are on higher parts of the landscape.

Typical pedon of Pinhook loam, in a cultivated field, 1,230 feet east and 1,350 feet north of the southwest corner of sec. 29, T. 36 N., R. 1 W.

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

A2—8 to 12 inches; gray (10YR 6/1) loam; few fine distinct yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) mottles; weak medium platy structure; friable; few fine tubular pores; few dark gray (10YR 4/1) worm casts and thin linings in pores and old root zones; slightly acid; clear wavy boundary.

B21t—12 to 20 inches; gray (10YR 6/1) loam; common medium distinct yellowish brown (10YR 5/6) and few medium distinct dark yellowish brown (10YR

4/4) mottles; moderate medium subangular blocky structure; firm; common fine vesicular and tubular pores lined with thin dark brown (10YR 4/3) and black (10YR 2/1) organic and clay films; few black iron-manganese concretions; strongly acid; clear wavy boundary.

B22t—20 to 30 inches; gray (10YR 6/1) sandy loam; few coarse distinct dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; weak medium and coarse subangular blocky structure; friable; white (N 8/0) silt coatings (dry) on faces of some peds; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of some peds and clay linings in pores; 10 percent shale; few black iron-manganese oxide concretions; strongly acid; clear wavy boundary.

B23t—30 to 39 inches; gray (10YR 6/1) sandy loam; few coarse distinct strong brown (7.5YR 5/6) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium and coarse subangular blocky structure; very friable; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds and clay linings of some pores; few black iron-manganese oxide concretions; 10 percent shale; strongly acid; clear wavy boundary.

B3—39 to 51 inches; strong brown (7.5YR 5/6) and gray (10YR 6/1) stratified shaly sandy loam and loamy sand; weak coarse subangular blocky structure; very friable; 8 percent shale; strongly acid; clear wavy boundary.

IIC—51 to 60 inches; mottled gray (10YR 6/1) and yellowish brown (10YR 5/6) stratified loamy sand and sand; single grain; loose; 1 percent shale; strongly acid.

The solum ranges from 40 to 56 inches in thickness.

The A1 or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loam or sandy loam. The A1 or Ap horizon ranges from medium acid to neutral. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is loam or sandy loam. The A2 horizon ranges from strongly acid to slightly acid. The B2t horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is loam, sandy loam, shaly loam, or shaly sandy loam. The subhorizon in some pedons is loamy sand, sandy clay loam, or shaly sandy clay loam. The B2t horizon is strongly acid or very strongly acid. The IIC horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 6. It is stratified loamy sand, sand, shaly sand, or shaly loamy sand. The IIC horizon is strongly acid or very strongly acid.

Pipestone series

The Pipestone series consists of deep, somewhat poorly drained soils on lake plains and outwash plains. These soils are rapidly permeable in the solum and very rapidly permeable in the substratum. They formed in acid, sandy glaciofluvial deposits. Slope ranges from 0 to 2 percent.

Pipestone soils are similar to Morocco and Saugatuck soils and are adjacent to Newton soils. Morocco soils do not have a spodic horizon. Newton soils have a deep, dark surface layer and do not have a spodic horizon. Saugatuck soils have an ortstein horizon.

Typical pedon of Pipestone loamy fine sand in a unit of Saugatuck-Pipestone complex, in an idle field, 160 feet west and 1,300 feet south of the center of sec. 10, T. 38 N., R. 3 W.

Ap—0 to 9 inches; black (10YR 2/1) loamy fine sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; common fine roots; medium acid; abrupt smooth boundary.

A2—9 to 15 inches; brown (7.5YR 5/2) very fine sand; common distinct pinkish gray (7.5YR 7/2) and dark brown (7.5YR 4/2) mottles; single grain; loose; few fine roots; strongly acid; clear wavy boundary.

B21hir—15 to 25 inches; reddish brown (5YR 4/4) fine sand; few medium distinct pinkish gray (7.5YR 6/2) mottles; single grain; loose; strongly acid; gradual wavy boundary.

B22ir—25 to 32 inches; strong brown (7.5YR 5/6) fine sand; few medium distinct reddish brown (5YR 4/4) mottles; single grain; loose; strongly acid; clear wavy boundary.

C—32 to 60 inches; light yellowish brown (10YR 6/4) fine sand; few medium distinct reddish brown (5YR 4/4) mottles; single grain; loose; strongly acid.

The solum ranges from 20 to 50 inches in thickness. It ranges from very strongly acid to medium acid.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. It is fine sand or loamy fine sand. The A2 horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 to 3. It is sand or fine sand. The B21ir horizon has hue of 5YR, 7.5YR, or 10YR; value of 2 to 5; and chroma of 2 to 6. It is sand or fine sand. Some pedons have some ortstein within the B21ir horizon. The B22 horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 to 6; and chroma of 3 to 8. It is sand or fine sand. The C horizon has hue of 10YR or 7.5YR; value of 5 to 7; and chroma of 2 to 6. It is sand or fine sand. The C horizon is very strongly acid to medium acid.

Quinn series

The Quinn series consists of deep, poorly drained soils on outwash plains. These soils are moderately permeable in the upper part of the solum and rapidly permeable in the lower part of the solum and in the substratum. They formed in shaly outwash sediment. Slope ranges from 0 to 2 percent.

Quinn soils are similar to Pinhook soils and are adjacent to Bourbon, Gilford, and Hanna soils. Pinhook soils have a darker surface horizon. Bourbon soils have a subsoil that is dominantly brown. Gilford soils have a thick, dark surface layer and are on slightly lower parts of the landscape. Hanna soils have a brown subsoil that has gray mottles in the lower part and are on slightly higher parts of the landscape.

Typical pedon of Quinn loam, in a cultivated field, 300 feet south and 920 feet east of the northwest corner of sec. 32, T. 35 N., R. 2 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; moderate medium and fine granular structure; friable; common fine and very fine roots; neutral; abrupt smooth boundary.

B21tg—8 to 16 inches; light brownish gray (10YR 6/2) loam; many medium prominent strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; common fine and very fine roots; common fine and medium tubular pores and random constricted simple pores; medium patchy very dark gray (10YR 3/1) clay films in old root channels and worm casts; 2 percent shale; very strongly acid; clear wavy boundary.

B22tg—16 to 21 inches; grayish brown (10YR 5/2) loam; common fine faint gray (10YR 6/1) and common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common very fine roots; thin discontinuous gray (10YR 5/1) clay films in old root channels and linings in pores and on some faces of peds; 8 percent fine gravel and shale; very strongly acid; clear wavy boundary.

B23tg—21 to 27 inches; gray (10YR 6/1) sandy loam; common medium distinct dark brown (10YR 3/3) and yellowish brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; thin discontinuous gray (10YR 5/1) clay films in root channels and pores and on some faces of peds; 13 percent fine gravel and shale; very strongly acid; clear wavy boundary.

B31—27 to 32 inches; grayish brown (10YR 5/2) loamy sand; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; very friable; 13 percent shale; very strongly acid; clear wavy boundary.

B32—32 to 44 inches; grayish brown (10YR 5/2) loamy sand; splotches of yellowish brown (10YR 5/4) and strong brown (7.5YR 5/8); weak coarse subangular blocky structure; very friable; very strongly acid; clear wavy boundary.

C—44 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; very strongly acid.

The solum ranges from 40 to 50 inches in thickness.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 1. In cultivated areas the Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is silt loam, loam, or sandy loam. The reaction in the A1 or Ap horizon ranges from very strongly acid to neutral. The B2t horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. Mottles range from common to many and faint to prominent. The B2t horizon is loam or sandy loam. It ranges from very strongly acid to medium acid. The B3 horizon is similar in color to the B2t horizon. It is sandy loam or loamy sand and strata of sandy clay loam. The C horizon is loamy sand, sand, shaly loamy sand, or shaly sand. It ranges from very strongly acid to medium acid.

Riddles series

The Riddles series consists of deep, well drained soils that are moderately permeable. These soils are on till plains and moraines. They formed in loamy glacial till. Slope ranges from 0 to 45 percent.

Riddles soils are similar to the Morley soils and are in the landscape with Homer, Tracy, and Washtenaw soils. Morley soils have more clay throughout the solum. Homer soils are on flatter parts of the landscape, have a mottled subsoil, and have a stratified substratum. Tracy soils have less clay in the B horizon and the underlying material is sand and shaly and gravelly sand. The Washtenaw soils are in depressions and drainageways and have buried horizons.

Typical pedon of Riddles loam, 2 to 6 percent slopes, eroded, in a cultivated field, 100 feet west and 60 feet north of the southeast corner of sec. 9, T. 36 N., R. 4 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; common roots; 5 percent shale and gravel; specks of brown (10YR 5/3) loam; neutral; abrupt smooth boundary.

B1—8 to 14 inches; brown (10YR 5/3) loam; moderate fine and medium subangular blocky structure; firm; common roots; 5 percent shale and gravel; slightly acid; clear wavy boundary.

B21t—14 to 24 inches; yellowish brown (10YR 5/4) clay loam; few fine distinct strong brown (7.5YR 5/6) and yellowish red (5YR 4/8) mottles; moderate medium and coarse subangular blocky structure; firm; thin patchy dark brown (10YR 3/3) clay films on faces of peds; 5 percent shale; medium acid; clear wavy boundary.

B22t—24 to 33 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct strong brown (7.5YR 5/6) and yellowish red (5YR 4/8) mottles; moderate medium subangular blocky structure; firm; thin patchy brown (10YR 4/3) clay films on faces of peds; 5 percent shale; medium acid; clear wavy boundary.

B23t—33 to 41 inches; yellowish brown (10YR 5/4) clay loam; moderate medium and coarse subangular blocky structure; firm; thin patchy brown (10YR 4/3) clay films on faces of peds; 5 percent shale and gravel; medium acid; clear wavy boundary.

B3t—41 to 47 inches; dark brown (7.5YR 4/4) sandy clay loam; weak coarse subangular blocky structure;

friable; patchy clay bridges between sand grains; 15 percent shale and gravel; medium acid; clear wavy boundary.

C—47 to 60 inches; strong brown (7.5YR 5/6) loam; massive; friable; 10 percent shale and gravel; neutral.

The solum ranges from 40 to 60 inches in thickness.

The A horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is loam, silt loam, or sandy loam. The A horizon ranges from medium acid to neutral. The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam, loam, or sandy clay loam. The B2 horizon ranges from strongly acid to neutral. The C horizon is loam, clay loam, or sandy loam. It ranges from neutral to moderately alkaline.

Saugatuck series

The Saugatuck series consists of deep, poorly drained soils on lake plains and outwash plains. Permeability is slow in the subsoil and rapid in the substratum. These soils formed in acid, sandy glaciofluvial sediment. Slope ranges from 0 to 2 percent.

These soils do not have mottles in the A2 horizon or in the ortstein horizons as is defined for the series. These differences do not alter the usefulness or behavior of these soils.

Saugatuck soils are similar to Pipestone soils and are in the landscape with Morocco, Newton, and Pipestone soils. Morocco soils have a brownish subsoil that is mottled and do not have an ortstein or a spodic horizon. The Newton soils have a deep, black surface layer. Pipestone soils have a brownish subsoil that is mottled and do not have the ortstein horizon.

Typical pedon of Saugatuck loamy fine sand in a unit of Saugatuck-Pipestone complex, in a wooded area, 1,220 feet south and 200 feet east of the center of sec. 10, T. 38 N., R. 3 W.

A1—0 to 4 inches; black (10YR 2/1) loamy fine sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; many fine and medium roots; many white (10YR 8/1) sand grains; strongly acid; clear wavy boundary.

A2—4 to 10 inches; grayish brown (10YR 5/2) fine sand; single grain; loose; few medium and coarse roots; very strongly acid; clear wavy boundary.

B21hir—10 to 13 inches; dusky red (2.5YR 3/2) fine sand; massive parting to single grain; weakly cemented; extremely acid; clear wavy boundary.

B22hirm—13 to 24 inches; dark reddish brown (5YR 3/4) fine sand; massive; strongly cemented; very strongly acid; clear wavy boundary.

B3—24 to 30 inches; light yellowish brown (10YR 6/4) fine sand; discontinuous chunks of yellowish brown (10YR 5/6) ortstein; single grain, massive in the ortstein chunks; loose, weakly cemented in the ortstein chunks; very strongly acid; clear wavy boundary.

C1—30 to 49 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; very strongly acid; clear wavy boundary.

C2—49 to 60 inches; brown (7.5YR 5/4) fine sand; single grain; loose; very strongly acid.

The solum ranges from 20 to 50 inches in thickness. It ranges in reaction from extremely acid to strongly acid.

The A1 horizon has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 1 or 2. Cultivated areas have an Ap horizon that has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The A2 horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. The A horizon is fine sand or loamy fine sand. The B21hir horizon has hue of 2.5YR or 5YR, value of 2 or 3, and chroma of 2 to 4. The B22hirm horizon has hue of 2.5YR or 5YR, value of 2 to 4, and chroma of 2 to 6. The B3 horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 to 6; and chroma of 4 to 8. The C horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 to 7; and chroma of 2 to 4.

Sebewa series

The Sebewa series consists of deep, very poorly drained soils on outwash plains and terraces. These soils are moderately permeable in the solum and rapidly permeable in the IIC horizon. They formed in loamy glacial outwash. Slope ranges from 0 to 2 percent.

Sebewa soils are similar to Gilford and Suman soils and are adjacent to Bourbon and Pinhook soils in the landscape. Gilford soils have less clay throughout the solum. Bourbon soils have a dark surface layer that is less than 10 inches thick, they have a B2 horizon that has less clay, and they are dominantly brown below the plow layer. Pinhook soils have a dark surface layer that is less than 10 inches thick, and the B2 horizon has less clay. Organic matter in the Suman soils decreases irregularly with depth throughout the profile.

Typical pedon of Sebewa loam, shaly sand substratum, in a cultivated field, 100 feet west and 2,590 feet south of the northeast corner of sec. 6, T. 33 N., R. 4 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; 1 percent shale; neutral; abrupt smooth boundary.

A12—9 to 16 inches; very dark brown (10YR 2/2) clay loam; few fine faint yellowish red (5YR 4/8) mottles; weak medium subangular blocky structure parting to moderate fine granular; firm; 1 percent shale; neutral; clear wavy boundary.

B21tg—16 to 26 inches; gray (10YR 6/1) clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; many thin continuous dark gray (10YR 4/1) clay films on faces of peds; 1 percent shale; neutral; clear wavy boundary.

B22tg—26 to 36 inches; grayish brown (10YR 5/2) sandy clay loam and pockets of loamy sand and clay loam; many distinct yellowish brown (10YR 5/4) and strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; 2 percent shale and gravel; neutral; clear wavy boundary.

IIC1g—36 to 43 inches; grayish brown (10YR 5/2) sand; common medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) mottles; single grain; loose; 5 percent shale and gravel; slight effervescence; mildly alkaline; gradual wavy boundary.

IIC2g—43 to 55 inches; grayish brown (10YR 5/2) shaly and gravelly sand; common medium distinct dark yellowish brown (10YR 4/4) mottles; 20 percent shale and gravel; single grain; loose; slight effervescence; mildly alkaline; gradual wavy boundary.

IIIC3g—55 to 60 inches; grayish brown (10YR 5/2) coarse sand and shaly and gravelly sand; few medium distinct dark yellowish brown (10YR 4/4) mottles; 40 to 45 percent shale and gravel; single grain; loose; slight effervescence; mildly alkaline.

The solum is 24 to 40 inches thick.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loam or clay loam. The Ap horizon is slightly acid or neutral. The B2 horizon has hue of 10YR or 5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam, sandy clay loam, shaly and gravelly clay loam, or loam. The B2 horizon is slightly acid or neutral. The IIC horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6; and chroma of 1 or 2. It is sand, shaly and gravelly sand, or coarse sand.

Selfridge series

The Selfridge series consists of deep, somewhat poorly drained soils on lake plains and till plains. These soils are rapidly permeable in the upper part of the solum and moderately permeable or moderately slowly permeable in the lower part of the solum and the substratum. They formed in sandy deposits, beach ridges or low sand dunes, over loamy till or lacustrine material. Slope ranges from 0 to 6 percent.

Selfridge soils are similar to Blount soils and are commonly near Cheektowaga soils. Blount soils have more clay in the solum than the Selfridge soils. Cheektowaga soils have a dark surface layer and are in drainageways and swales.

Typical pedon of Selfridge loamy fine sand, 0 to 2 percent slopes, in a pasture, 2,620 feet east and 80 feet south of the northwest corner of sec. 19, T. 38 N., R. 3 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loamy fine sand, light brownish gray (10YR 6/2) dry; moderate medium granular structure; very friable; many roots; medium acid; abrupt boundary.

B1—8 to 13 inches; yellowish brown (10YR 5/4) loamy fine sand; common medium distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure parting to moderate medium granular; very friable; common fine roots; 2 percent fine gravel; neutral; clear wavy boundary.

B21—13 to 22 inches; pale brown (10YR 6/3) sand; single grain; loose; few fine roots; 2 percent fine gravel; neutral; clear wavy boundary.

B22t—22 to 25 inches; dark yellowish brown (10YR 4/4) sandy loam; common medium and coarse distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; friable; clay bridges between sand grains; 2 percent fine gravel; neutral; abrupt smooth boundary.

IIB23t—25 to 30 inches; brown (10YR 4/3) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; very firm; thick continuous gray (5Y 5/1) clay films on faces of peds; 5 percent fine gravel; slight effervescence; mildly alkaline; clear wavy boundary.

IIB3—30 to 40 inches; dark grayish brown (10YR 4/2) clay loam; common medium faint dark yellowish brown (10YR 4/4) mottles; weak coarse prismatic structure; very firm; thick continuous gray (N 6/0) silt films on faces of some prisms; common very pale brown (10YR 8/3) calcium carbonate accumulations; 5 percent fine gravel; strong effervescence; moderately alkaline; clear wavy boundary.

IIC—40 to 60 inches; brown (10YR 5/3) clay loam; common medium distinct reddish gray (5YR 5/2) mottles; massive; very firm; common white (10YR 8/2) calcium carbonate accumulations; 5 percent fine gravel; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. The loamy fine sand or sand is 20 to 30 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. It is loamy fine sand, fine sand, or loamy sand. The Ap horizon ranges from medium acid to neutral. The B2t horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is loam or sandy loam. The B2t horizon ranges from slightly acid to mildly alkaline. The IIB2t horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is silty clay loam or clay loam. The IIB2t horizon is neutral or mildly alkaline. The IIC horizon has the same range of color and the same textures as described for the IIB2t horizon. It is mildly alkaline or moderately alkaline.

Suman series

The Suman series consists of deep, very poorly drained soils on flood plains of major streams or along narrow stream bottoms. These soils are moderately slowly permeable in the subsoil and are rapidly permeable in the underlying material. They formed in alluvium from calcareous Wisconsinan Age drift. Slope ranges from 0 to 2 percent.

Suman soils are similar to Sebewa soils and are adjacent to Adrian and Cohoctah soils and to Fluvaquents. Organic matter in Sebewa soils decreases regularly with depth. The Adrian soil has an organic layer over sand. Cohoctah soils have less clay throughout the solum. Fluvaquents do not have the dark colored surface layer that is more than 10 inches thick that the Suman soils have and are on slightly higher parts of the landscape.

Typical pedon of Suman silty clay loam, in a wooded area, 1,100 feet north and 100 feet west of the southeast corner of sec. 32, T. 33 N., R. 4 W.

A11—0 to 13 inches; black (10YR 2/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; strong fine and very fine angular and subangular blocky structure; firm; many fine and medium roots; neutral; clear wavy boundary.

A12—13 to 22 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; coarse distinct dark reddish brown (5YR 3/4) and dark brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine and medium roots; neutral; clear wavy boundary.

B2g—22 to 34 inches; dark gray (10YR 4/1) clay loam and lenses and pockets of brown (10YR 5/3) and pale brown (10YR 6/3) fine sand; many coarse distinct dark reddish brown (5YR 3/3) and dark brown (7.5YR 4/4) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; few fine roots; neutral; abrupt wavy boundary.

IIC1g—34 to 48 inches; light brownish gray (10YR 6/2) stratified loamy fine sand and fine sand; common coarse faint pale brown (10YR 6/3) mottles; single grain; loose; very few fine roots; neutral; clear wavy boundary.

IIC2g—48 to 60 inches; stratified layers of dark brown (7.5YR 4/4) fine sand and dark gray (10YR 4/1) loamy fine sand; common coarse distinct pale brown (10YR 6/3) mottles; single grain; loose; few dark brown (7.5YR 4/4) iron accumulations; neutral.

The solum ranges from 24 to 40 inches in thickness. The mollic epipedon ranges from 10 to 24 inches in thickness.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2 or is black (N 2/0). It is silty clay loam, clay loam, silt loam, or loam. The Ap or A1 horizon is slightly acid or neutral. The B horizon is dark gray (N 4/0, 10YR 4/1) or gray (N 5/0, 10YR 5/1) or has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2. It is mottled loam, clay loam, or silty clay loam. The B horizon ranges from neutral to moderately alkaline. The C horizon is stratified loamy fine sand, sand, and fine sand. It is neutral or mildly alkaline.

Tracy series

The Tracy series consists of deep, well drained soils on outwash plains. These soils are moderately permeable in the solum and rapidly permeable in the substratum. They formed in glacial outwash that has a fairly large amount of shale fragments and a low amount of carbonates. Slope ranges from 0 to 45 percent.

Tracy soils are similar to the Elston soils, and are commonly adjacent to Bourbon, Coupee, and Hanna soils in the landscape. Elston soils have a mollic epipedon, and the solum is less acid than that of the Tracy soils. Bourbon soils have mottles immediately below the plow layer and a dark colored surface layer. Coupee soils have a mollic epipedon. Hanna soils have mottles in the upper part of the subsoil.

Typical pedon of Tracy sandy loam, 2 to 6 percent slopes, in a cultivated field, 340 feet east and 1,220 feet south of the northwest corner of sec. 5, T. 35 N., R. 3 W.

Ap—0 to 8 inches; dark brown (10YR 3/3) sandy loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable; few roots; 2 percent gravel and shale; slightly acid; abrupt wavy boundary.

B21—8 to 14 inches; dark brown (10YR 4/3) sandy loam; weak fine and medium subangular blocky structure; friable; few roots; 2 percent gravel and shale; slightly acid; clear wavy boundary.

B22t—14 to 25 inches; dark brown (7.5YR 4/4) loam; weak fine and medium subangular blocky structure; friable; thin patchy dark brown (10YR 3/3) clay films on faces of peds; 10 percent gravel and shale; strongly acid; gradual wavy boundary.

B23t—25 to 32 inches; dark brown (7.5YR 4/4) gravelly sandy clay loam; weak fine and medium subangular blocky structure; friable thin patchy dark brown (10YR 3/3) clay films on faces of peds and as bridging between sand grains; 20 percent gravel and shale; very strongly acid; gradual wavy boundary.

B24t—32 to 40 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak fine subangular blocky structure; friable; thin patchy dark brown (10YR 3/3) clay films that are on faces of peds and bridge sand grains; 30 percent fine gravel and shale; very strongly acid; gradual wavy boundary.

B3—40 to 46 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; very strongly acid; clear wavy boundary.

C—46 to 60 inches; pale brown (10YR 6/3) and dark brown (7.5YR 4/4) stratified sand and loamy sand; single grain; loose; 3 percent shale; very strongly acid.

The solum is 36 to 60 inches thick.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 3 or 4 and is sandy loam or loam. Uncultivated areas have an A1 horizon that has hue of 10YR, value of 2 or 3, and chroma of 2 and is sandy loam or loam. The Ap or A1 horizon is very strongly acid unless it is limed. The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam or sandy loam or has subhorizons of clay loam. The B2 horizon is 5 to 20 percent gravel and shale in the upper part and 5 to 30 percent in the lower part. It is strongly acid or very strongly acid. The B3 horizon ranges from no gravel and shale to 30 percent gravel and shale. It is strongly acid or very strongly acid. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4 and is sand, loamy sand, or strata of sand, gravelly sand, loamy sand, and some shale.

Troxel series

The Troxel series consists of deep, well drained soils that are moderately permeable. These soils are in depressions or concave positions on loess covered outwash and glacial plains. They formed in silty material and the underlying sandy and loamy outwash material. Slope ranges from 0 to 2 percent.

These soils have more sand in the lower part of the solum than is defined as the range for the series, but this difference does not alter the usefulness or behavior of these soils.

Troxel soils are adjacent to Coupee, Elston, and Tracy soils. The Coupee and Elston soils have a dark surface horizon less than 24 inches thick. The Tracy soils have a lighter colored surface horizon. All of these soils are loamy and are on the slopes around the Troxel soils and on the broad flats.

Typical pedon of Troxel silt loam, in a cultivated field, 940 feet east and 180 feet south of the northwest corner of sec. 5, T. 35 N., R. 4 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common roots; medium acid; abrupt smooth boundary.

A12—10 to 25 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; common roots; medium acid; clear wavy boundary.

A13—25 to 30 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; few roots; medium acid; abrupt wavy boundary.

A3—30 to 35 inches; dark brown (10YR 3/3) silt loam; weak medium subangular blocky structure parting to weak medium and coarse granular; friable; very few roots; medium acid; clear wavy boundary.

IIB21t—35 to 47 inches; brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; medium acid; clear wavy boundary.

IIB22t—47 to 54 inches; dark brown (10YR 3/3) loamy sand; weak coarse subangular blocky structure; friable; clay bridges between sand grains; 15 percent shale fragments; medium acid; clear wavy boundary.

IIB3—54 to 60 inches; dark brown (10YR 4/3) sand and dark brown (7.5YR 3/2) bands of loamy sand, 1/8 and 1/2 inch thick; single grain; massive in the bands of loamy sand; loose; friable in loamy sand; neutral; gradual wavy boundary.

IIC—60 to 80 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; neutral.

The solum is 60 to 96 inches thick. The mollic epipedon is 24 to 40 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is silt loam or loam. The A horizon ranges from medium acid to neutral. The B horizon has hue of 10YR, value of 3 to 5, and chroma of 3 to 6. It is loam, loamy sand or silt loam. It ranges from medium acid to neutral. The C horizon is sandy loam, sand, or gravelly sand.

Tyner series

The Tyner series consists of deep, somewhat excessively drained soils on outwash plains of uplands. These soils are rapidly permeable in the solum and very rapidly permeable in the substratum. They formed in strongly acid sandy material from glacial drift that has been reworked by wind. Slope ranges from 0 to 2 percent.

Tyner soils are similar to Oakville soils and are adjacent to Hanna and Tracy soils. Oakville soils are dominantly fine and very fine sand in the solum. Hanna soils have more clay than the Tyner soils, are mottled in the lower part of the subsoil, and are on slightly lower positions in the landscape. Tracy soils have more clay throughout the profile.

Typical pedon of Tyner loamy sand, 0 to 2 percent slopes, in a cultivated field, 1,380 feet north and 190 feet west of the southeast corner of sec. 13, T. 34 N., R. 4 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) loamy sand, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; common fine roots; yellow (10YR 7/6) worm casts; 3 percent gravel; slightly acid; abrupt smooth boundary.

A12—10 to 13 inches; dark yellowish brown (10YR 4/6) loamy sand; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium granular structure; very friable; few fine roots; 3 percent gravel; medium acid; clear wavy boundary.
B21—13 to 28 inches; yellowish brown (10YR 5/6) loamy sand; weak medium granular structure; very friable; very few fine and medium roots; 3 percent gravel; slightly acid; clear wavy boundary.
B22—28 to 40 inches; yellowish brown (10YR 5/6) loamy sand; weak fine granular structure; very friable; 3 percent gravel; medium acid; clear wavy boundary.
C—40 to 60 inches; brownish yellow (10YR 6/6) sand; common medium distinct dark yellowish brown (10YR 4/4) mottles; single grain; loose; 3 percent gravel; medium acid.

The solum ranges from 36 to 42 inches in thickness.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It ranges from medium acid to neutral. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It ranges from very strongly acid to medium acid. The C horizon is fine sand or sand. It is very strongly acid to medium acid.

Wallkill series

The Wallkill series consists of deep, very poorly drained soils. These soils are on flood plains or in margins around organic soils that are adjacent to uplands. They are moderately permeable in the mineral part and are moderately slowly permeable to moderately rapidly permeable in the organic material. They formed in alluvium over organic material. Slope ranges from 0 to 2 percent.

These soils have more silt in the mineral material than is defined as the range for the series, but this difference does not alter the usefulness or behavior of these soils.

Wallkill soils are similar to Warners and Washtenaw soils and are adjacent to Houghton, Morley, Palms, Riddles, and Tracy soils. The Houghton and Palms soils are organic. The Morley, Riddles, and Tracy soils are on sloping uplands around the Wallkill soils. Warners soils have more silt in the surface soil and are underlain by marl. Washtenaw soils are loamy throughout the profile.

Typical pedon of Wallkill silt loam, in an idle field, 180 feet north and 1,510 feet west of the southeast corner of sec. 33, T. 37 N., R. 4 W.

A11—0 to 3 inches; dark grayish brown (2.5Y 4/2) silt loam, light brownish gray (2.5Y 6/2) dry; weak medium granular structure; friable; many fine roots; neutral; clear wavy boundary.
A12—3 to 10 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; many medium distinct olive brown (2.5Y 4/4) mottles; weak coarse subangular blocky structure; firm; common fine roots; neutral; clear wavy boundary.
Bg—10 to 20 inches; olive gray (5Y 4/2) silty clay loam; common medium distinct olive brown (2.5Y 4/4) and yellowish red (5YR 4/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; neutral; clear wavy boundary.
Cg—20 to 27 inches; dark gray (5Y 4/1) silty clay loam; massive; firm; neutral; abrupt wavy boundary.
IIOa—27 to 60 inches; dark reddish brown (5YR 2/2) sapric material, black (5YR 2/1) rubbed; 35 percent fiber, less than 8 percent rubbed; massive; friable; slightly acid.

The mineral soil over the organic material ranges from 16 to 30 inches in thickness.

The A1 or Ap horizon has hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 1 or 2. It is loam or silt loam. The A1 or Ap horizon ranges from strongly acid to neutral. The Bg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It dominantly is silt loam or silty clay loam but ranges to loam. It is medium acid or neutral. Some pedons do not have a Bg horizon, and in some the Bg horizon extends to the contact with the organic layer. The underlying IIO horizon is hemic or sapric. It ranges from medium acid to neutral.

Warners series

The Warners series consists of deep, very poorly drained soils on flood plains. These soils are moderately slowly permeable or moderately permeable in the mineral material and variable in the underlying marl. They formed in alluvial material near areas where water charged with calcium carbonate seeps out of the soil. Slope ranges from 0 to 2 percent.

Warners soils are similar to Edwards, Martisco, and Wallkill soils and are adjacent to Suman soils and Fluvaquents. The Edwards and Martisco soils formed in muck over marl. The Fluvaquents and Suman soils are not underlain with marl. Wallkill soils are underlain by muck.

Typical pedon of Warners silt loam, in an idle field, 2,320 feet west and 940 feet north of the southeast corner of sec. 33, T. 37 N., R. 4 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate medium subangular structure parting to moderate fine and medium granular; friable; common fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.
A12g—10 to 13 inches; dark grayish brown (2.5Y 4/2) silt loam; light brownish gray (2.5Y 6/2) dry; many fine distinct dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; friable; few fine roots; common fine black (N 2/0) organic stains; slight effervescence; mildly alkaline; clear wavy boundary.

A13g—13 to 17 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; common fine distinct dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; friable; common fine black (N 2/0) organic stains and light brownish gray (10YR 6/2) streaks; slight effervescence; mildly alkaline; abrupt wavy boundary.
A3g—17 to 20 inches; black (N 2/0) mucky silt loam; massive; firm; very few fine faint dark brown (7.5YR 4/4) decayed roots; neutral; abrupt wavy boundary.
IILca1—20 to 54 inches; white (10YR 8/1) marl; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; violent effervescence; moderately alkaline; clear wavy boundary.
IILca2—54 to 60 inches; gray (5Y 6/1) marl; massive; friable; violent effervescence; moderately alkaline.

Depth to marl or to friable material impregnated with carbonates ranges from 12 to 32 inches.

The A1 or Ap has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 to 3. It is silt loam, loam, or silty clay loam. The A1 or Ap horizon ranges from slightly acid to mildly alkaline. The A3 horizon is muck or mucky silt loam 2 to 6 inches thick. The ILLca horizon has hue of 10YR or 2.5Y, value of 5 to 8, and chroma of 1 or 2. It is marl or material permeated with carbonates.

Washtenaw series

The Washtenaw series consists of deep, poorly drained soils that are nearly level and in depressions of moraines, till plains, and outwash plains. These soils are moderately permeable in the solum and slowly permeable in the substratum. They formed in alluvium and the underlying glacial drift. Slope ranges from 0 to 2 percent.

Washtenaw soils are similar to Wallkill soils and are adjacent to Coupee, Elston, Morley, Riddles, and Tracy soils. Wallkill soils are underlain by muck. Coupee, Elston, Morley, Riddles, and Tracy soils are all on the sloping uplands that surround the Washtenaw soils.

Typical pedon of Washtenaw silt loam, in an idle field, 1,100 feet north and 1,540 feet west of the southeast corner of sec. 26, T. 37 N., R. 4 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; few fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak fine and medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.
B21g—5 to 22 inches; grayish brown (10YR 5/2) silt loam; common fine and medium distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; many roots; dark reddish brown (5YR 3/2) concretions; slightly acid; clear wavy boundary.
B22g—22 to 29 inches; light brownish gray (10YR 6/2) silt loam; common fine and medium distinct yellowish brown (10YR 5/6) and yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; friable; few roots; slightly acid; abrupt smooth boundary.
A1b—29 to 36 inches; black (10YR 2/1) silty clay loam; moderate medium and coarse subangular blocky structure; firm; thick discontinuous light gray (10YR 7/2) silt coatings on vertical faces of peds; slightly acid; clear wavy boundary.
B2b—36 to 40 inches; grayish brown (10YR 5/2) silt loam; common medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; slightly acid; clear wavy boundary.
A2b—40 to 55 inches; black (10YR 2/1) silt loam; few fine faint yellowish brown (10YR 5/4) and light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; friable; slightly acid; clear wavy boundary.
C—55 to 60 inches; dark gray (10YR 4/1) silty clay loam; massive; firm; medium patchy gray (10YR 6/1) clay films lining old root channels; slightly acid.

The overwash ranges from 20 to 40 inches in thickness, and the underlying buried soil ranges from 24 to 40 inches in thickness.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is silt loam or loam. The B horizon or the C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is silt loam or loam. The Ab horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. They are silt loam, loam, silty clay loam, or clay loam. The B2b horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2 and is silt loam, silty clay loam, or clay loam. The C horizon is loam, silty clay loam, clay loam, or sand.

formation of the soils

In this section the major factors of soil formation and their degree of importance in the formation of the soils in the county are discussed.

factors of soil formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agents. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated from the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determine it almost entirely. Finally time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually 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 effects of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

parent material

Parent material is the unconsolidated mass from which a soil is formed. The parent material of the soils of La Porte County was deposited by glaciers or by melt water from the glaciers. Some of this material has been reworked and redeposited by subsequent actions of water and wind. The glaciers covered the county from about 10,000 to 12,000 years ago. Parent material determines the limits of the chemical and mineralogical composition of the soil. Although parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in La Porte County were 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. It consists of particles of different sizes that are mixed together. Some small pebbles in glacial till have sharp corners, which indicate that they had not been worn by washing water. The glacial till in La Porte County is calcareous and firm. Its texture is clay loam. An example of soils formed in glacial till are those of the Blount series. These soils typically have a moderately fine textured subsoil 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 speed of the stream of water that carried them. When the water slows down, the coarser particles are deposited. Finer particles, such as very fine sand, silt, and clay, are carried by slower moving water. Outwash deposits generally consist of layers of particles of similar size, such as loam, sand, gravel, and other coarse particles. The Bourbon soils, for example, formed in deposits of outwash material in La Porte County.

Lacustrine materials are deposited from still, or ponded, glacial melt water. Because the coarser fragments drop out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remain to settle out in still water. Lacustrine deposits are silty or clayey in texture. In La Porte County soils formed in lacustrine deposits are typically moderately fine textured. The Milford series is an example of soils formed in lacustrine material.

Alluvium is material deposited by floodwaters of present streams in recent time. This material ranges in texture, depending on the speed of the water from which it was deposited. The alluvium material deposited along a swift stream like Trail Creek is, therefore, coarser textured than that deposited along a slow, sluggish stream like the Kankakee River. Examples of alluvial soils are the Fluvaquents and Suman soils.

Organic material is made up of deposits of plant remains. After the glaciers withdrew from the area, water was left standing in depressions in outwash, lake, and till plains. Grasses and sedges growing around the edges of these lakes died, and their remains fell to the bottom. Because of the wetness of the areas, the plant remains did not decompose but remained around the edge of the lake. Later tamarack and other water-tolerant trees grew on the areas. As these trees died, their residues became a part of the organic accumulation. The lakes were eventually filled with organic material and developed into areas of muck and peat. In some of these areas, the plant remains subsequently decomposed. In other of the areas, the material has changed little since deposition. Soils of the Houghton series are an example of soils formed in organic material.

plant and animal life

Plants have been the principal organism influencing the soils in La Porte County; however, bacteria, fungi, earthworms, and the activities of man have also been important. The chief contribution of plants and animal life is the addition of organic matter and nitrogen into the soil. The kind of organic material on and in the soil depends on the kind of plants that grew on the soil. The remains of these plants accumulate in the surface, decay, and eventually become organic matter. Roots of the plants provide channels for downward movement of water through the soil and also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The vegetation in La Porte County was mainly mixed forests. Differences in natural soil drainage and minor changes in parent material have affected the composition of the forest species. Some areas had prairie vegetation.

In general the well drained soils, such as the Tracy and Riddles series, were mainly covered with oak, beech, ash, walnut, sugar maple, and soft maple. The Oakville soils were covered with white pine and scrub oak. The well drained Coupee and Elston soils were mainly covered by grasses, such as big bluestem, little bluestem, indiangrass, and groves of bur oak. The wet soils were covered with soft maple, ash, swamp white oak, basswood, cedar, and tamarack. If they had more marshy conditions, they were covered by marsh plants that included sedges, rushes, and coarse grasses. A few wet soils also had sphagnum and other mosses which contributed substantially to the accumulation of organic matter. The Gilford and Sebawa soils formed under wet conditions and have a considerable amount of organic matter. The Adrian and Houghton soils formed under high water and are organic soils. Thus, the soils of La Porte County that formed under dominantly forest vegetation generally have less total accumulated organic matter than soils, in other parts of the county, that formed under dominantly grass vegetation.

climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil. It determines the amount of water available for weathering of minerals and the transporting of soil materials. Climate, by its influence on temperatures in the soil, determines the rate of chemical reaction that occurs in the soil. These influences are important, but they affect large areas rather than a relatively small area, such as a county.

The climate in La Porte County is cool and humid. This is presumably similar to that which existed when the soils formed. The soils in La Porte County differ from soils 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 of Lake Michigan. Therefore, the differences in the soils of La Porte County, to a minor extent, are the results of the differences in climate. For more detailed information on the climate of this county, see the section "General Nature of the County."

relief

Relief, or topography, has a marked influence on the soils of La Porte County by its influence on natural drainage, erosion, plant cover, and soil temperature. In La Porte County slopes range from 0 to 45 percent. Natural soil drainage ranges from well drained on the ridgetops to very poorly drained in the depressions.

Relief influences the formation of soils by affecting runoff and drainage; drainage, in turn, by its affect on aeration of the soil, determines the color of the soil. Runoff of water is greatest on the steeper slopes, but in low areas, water temporarily ponds. Water and air move freely through soils that are well drained but slowly through soils that are very poorly drained. In soils that are aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized, and in poorly aerated soils the color is a dull gray and mottled. The Tracy soils are an example of a well drained, well aerated soil, while the Maumee soils are an example of a poorly aerated, very poorly drained soil.

Intermediate, between the very poorly drained and well drained soils, are the poorly drained, somewhat poorly drained, and moderately well drained soils.

time

Time, usually a long time, is required by the agents of soil formation to develop distinct horizons in the soil from parent material. The differences in length of time that the parent material has been in place are commonly reflected in the degree of development of the soil profile. Some soils develop rapidly, others slowly.

The soils in La Porte County range from young to mature. The glacial deposits from which many of the soils in La Porte County formed have been exposed to soil-forming factors for a long enough time to allow distinct horizons to develop within the soil profile. The Riddles soils are an example of an older soil.

Some soils, however, forming in recent alluvial sediment have not been in place long enough for distinct horizons to develop. The Suman soils are an example of a young soil that formed in alluvial material.

The Morley and Riddles soils are older and are examples of soils in which the effectiveness of leaching of lime from the soil can be noted. The parent material of the Morley and Riddles soils had about the same amount of lime that the C horizon of these soils has today.

In another comparison, the Milford soil was submerged under glacial lake water and protected from leaching for many years. In contrast, the Tracy soils were above water and subject to leaching. The Milford soil is leached to about 39 inches and the Tracy soils to a depth of about 60 inches. The Tracy soils are much more permeable than the Milford soil. The difference in effectiveness of leaching is reflected in the depth to which the soils are leached of lime. The Riddles soils are leached to a depth of about 70 inches. On the other hand the Morley soils have free lime and are calcareous at a depth of about 42 inches. The difference is probably caused by more water passing through the more permeable material of the Riddles soils.

processes of soil formation

Several processes have been involved in the formation of the soils of this county. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; and the liberation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all the soils of this county. The organic matter content of some soils is low, but that of others is high. Generally the soils that have the most organic matter, such as soils of the Gilford or Sebewa series, have a thick black surface horizon.

Carbonates and bases have been leached from the upper horizons of nearly all the soils of this county. Leaching is generally believed to precede the translocation of silicate clay minerals. Most all of the carbonates and some of the bases have been leached from the A and B horizons of the well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by an acid reaction. Leaching of wet soils is slow because of a high water table or because water moves slowly through such soils.

Clay accumulates in pores and other voids and forms films on the surface along which water moves. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation in the soils of this county. Soils of the Morley series are examples of soils in which translocated silicate clays have accumulated in the B2t horizon in the form of clay films.

The reduction and transfer of iron, or gleying, has occurred in all of the very poor drained and somewhat poorly drained soils of this county. In the naturally wet soils, this process has been significant in horizon differentiation. The gray color of the subsoil indicates the redistribution of iron oxides. The reduction is commonly accompanied by some transfer of the iron, either from upper horizons to lower horizons or completely out of the profile. Mottles, which are in some horizons, indicate segregation of iron.

references

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 646 pp., illus.

(3) Conservation Needs Committee. 1968. Indiana soil and water conservation needs inventory. 224 pp., illus.

(4) Ulrich, H. P., W. J. Leighty, A. E. Shearin, and A. T. Wiancko. 1944. Soil survey of La Porte County, Indiana. U. S. Dept. of Agric.: Series 1934, No. 26, 110 pp., illus.

(5) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(6) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

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.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Controlled drainage. A water management system that allows the water table to be lowered or raised.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms. The Lco horizon is a limnic layer that contains many fecal pellets.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainage, subsurface. Removal of excess ground water by buried drains installed within the soil. The drains collect the water and convey it to a gravity or pump outlet.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal till. Compact glacial till deposited beneath the ice.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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 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.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the

soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

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.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Any surface soil horizon, A1, A2, or A3, below the surface layer.

Surface layer. 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."

Surface soil. The A horizon. Includes all subdivisions of this horizon, the A1, A2, and A3.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. 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.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at La Porte, Indiana]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	31.6	15.5	23.6	57	-14	9	2.42	1.34	3.29	6	17.4
February---	35.7	19.1	27.4	59	-10	11	2.31	1.05	3.32	6	16.1
March------	45.3	27.1	36.2	77	6	78	3.09	2.14	3.95	7	10.8
April------	60.1	38.1	49.1	84	21	280	4.52	2.47	6.19	8	2.0
May--------	71.6	47.5	59.6	91	29	608	3.41	2.30	4.42	7	.1
June-------	81.6	57.3	69.5	97	40	885	4.17	2.58	5.59	7	.0
July-------	84.7	61.7	73.2	98	47	1,029	4.89	3.02	6.56	8	.0
August-----	83.1	60.1	71.6	97	44	980	3.71	1.69	5.34	5	.0
September--	76.9	53.3	65.1	95	34	753	4.05	1.74	5.91	6	.0
October----	65.4	42.8	54.1	87	24	442	4.01	1.47	6.05	7	.1
November---	48.6	31.6	40.1	74	10	98	2.85	1.84	3.76	7	7.2
December---	36.1	21.5	28.9	62	-9	27	3.23	1.94	4.37	7	18.1
Year-----	60.1	39.6	49.9	100	-16	5,200	42.66	34.72	50.17	81	71.8

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at La Porte, Indiana]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 18	May 1	May 16
2 years in 10 later than--	April 12	April 26	May 11
5 years in 10 later than--	April 2	April 17	April 30
First freezing temperature in fall:			
1 year in 10 earlier than--	October 28	October 12	September 30
2 years in 10 earlier than--	November 1	October 17	October 5
5 years in 10 earlier than--	November 7	October 27	October 15

TABLE 3.--GROWING SEASON LENGTH

[Recorded in the period 1951-74 at La Porte, Indiana]

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	198	175	145
8 years in 10	205	181	153
5 years in 10	218	192	167
2 years in 10	231	203	181
1 year in 10	238	209	188

TABLE 4.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map Unit	Extent of area	Cultivated crops	Specialty crops	Woodland	Urban uses	Intensive recreation areas
	Pct					
1. Gilford-Maumee-Sebewa	13	Good: ponding.	Fair: ponding.	Poor: ponding.	Poor: ponding, poor filter.	Poor: ponding.
2. Cohoctah-Fluvaquents-Suman	7	Fair: wetness, floods.	Fair: wetness, floods.	Poor: wetness, floods.	Poor: wetness, floods.	Poor: wetness, floods.
3. Adrian-Houghton-Edwards	11	Good: ponding.	Good: ponding.	Poor: ponding.	Poor: ponding, excess humus, low strength.	Poor: ponding, excess humus.
4. Bourbon-Hanna-Pinhook	8	Good: wetness.	Good: wetness.	Fair: wetness.	Poor: wetness, poor filter.	Fair: wetness.
5. Tracy-Chelsea	31	Fair: droughty, slope.	Good: droughty, slope.	Good--------	Fair: poor filter, slope.	Poor: too sandy, slope.
6. Elston-Coupee	13	Good: droughty.	Good: droughty.	Good--------	Good: poor filter, slope.	Good.
7. Riddles	7	Fair: slope, erosion.	Fair: slope, erosion.	Good--------	Fair: percs slowly, slope, shrink-swell.	Fair: slope.
8. Blount-Selfridge	5	Good: wetness.	Fair: wetness.	Fair: wetness.	Poor: wetness, percs slowly.	Fair: wetness.
9. Oakville-Morocco-Brems	5	Fair: droughty, soil blowing.	Fair: droughty, soil blowing.	Fair: too sandy.	Poor: poor filter, wetness, slope.	Poor: too sandy.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ad	Adrian muck, drained	11,751	3.0
BaA	Blount silt loam, 0 to 3 percent slopes	9,728	2.5
Br	Bourbon sandy loam	19,834	5.1
BtA	Brems fine sand, 0 to 3 percent slopes	10,039	2.6
Cd	Cheektowaga fine sandy loam	623	0.2
ChB	Chelsea fine sand, 2 to 6 percent slopes	10,117	2.6
ChC	Chelsea fine sand, 6 to 12 percent slopes	4,942	1.3
ChD	Chelsea fine sand, 12 to 18 percent slopes	2,296	0.6
Ck	Cohoctah sandy loam	4,981	1.3
CoA	Coupee silt loam, 0 to 2 percent slopes	14,514	3.7
CoB	Coupee silt loam, 2 to 6 percent slopes	2,179	0.6
Du	Duneland	350	0.1
Ed	Edwards muck, drained	3,113	0.8
EsA	Elston loam, 0 to 2 percent slopes	23,567	6.1
EsB	Elston loam, 2 to 6 percent slopes	7,004	1.8
Fh	Fluvaquents, loamy	4,203	1.1
Gf	Gilford fine sandy loam	42,429	10.8
HaA	Hanna sandy loam, 0 to 3 percent slopes	15,098	3.9
Hh	Histosols and Aquolls	5,214	1.3
Hk	Homer loam	1,868	0.5
Hm	Houghton muck	5,876	1.5
Ho	Houghton muck, drained	6,187	1.6
Md	Martisco muck, drained	1,829	0.5
Mm	Maumee loamy fine sand	11,285	2.9
Mn	Maumee Variant loamy sand	778	0.2
Mp	Milford silty clay loam	350	0.1
MrB2	Morley silt loam, 2 to 6 percent slopes, eroded	1,323	0.3
MrC2	Morley silt loam, 6 to 12 percent slopes, eroded	662	0.2
MrD2	Morley silt loam, 12 to 18 percent slopes, eroded	311	0.1
Mx	Morocco loamy fine sand	9,028	2.3
Mz	Muskego muck, drained	739	0.2
Nf	Newton loamy fine sand	2,140	0.5
OaC	Oakville fine sand, 4 to 12 percent slopes	3,541	0.9
OaE	Oakville fine sand, 12 to 25 percent slopes	662	0.2
Pa	Palms muck, sandy substratum	3,035	0.8
Pe	Pewamo silty clay loam	1,595	0.4
Ph	Pinhook loam	9,884	2.5
Qu	Quinn loam	4,475	1.2
RlA	Riddles loam, 0 to 2 percent slopes	1,128	0.3
RlB2	Riddles loam, 2 to 6 percent slopes, eroded	9,845	2.5
RlC2	Riddles loam, 6 to 12 percent slopes, eroded	4,942	1.3
RlD2	Riddles loam, 12 to 18 percent slopes, eroded	3,541	0.9
RlF	Riddles loam, 25 to 45 percent slopes	856	0.2
Sa	Saugatuck-Pipestone complex	934	0.2
Sb	Sebewa loam, shaly sand substratum	3,658	0.9
SeA	Selfridge loamy fine sand, 0 to 2 percent slopes	2,101	0.5
SeB	Selfridge loamy fine sand, 2 to 6 percent slopes	1,829	0.5
So	Suman silty clay loam	2,296	0.6
TcA	Tracy sandy loam, 0 to 2 percent slopes	22,478	5.8
TcB	Tracy sandy loam, 2 to 6 percent slopes	32,941	8.4
TcC2	Tracy sandy loam, 6 to 12 percent slopes, eroded	13,697	3.5
TcD2	Tracy sandy loam, 12 to 18 percent slopes, eroded	5,097	1.3
TcF	Tracy sandy loam, 25 to 45 percent slopes	934	0.2
Tr	Troxel silt loam	2,724	0.7
TyA	Tyner loamy sand, 0 to 2 percent slopes	7,004	1.8
Ua	Udorthents, loamy	1,946	0.5
Uc	Urban land-Coupee complex	2,218	0.6
UoC	Urban land-Oakville complex, 1 to 10 percent slopes	1,595	0.4
Uv	Urban land-Morocco complex	1,518	0.4
Wa	Wallkill silt loam	739	0.2
We	Warners silt loam	662	0.2
Wh	Washtenaw silt loam	2,996	0.8
	Water	3,891	1.0
	Total	389,120	100.0

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
Ad----------------------- Adrian	75	23	---	---	---
BaA---------------------- Blount	106	35	48	4.3	7.2
Br----------------------- Bourbon	80	30	35	3.0	6.0
BtA---------------------- Brems	70	24	32	2.3	4.6
Cd----------------------- Cheektowaga	75	24	---	2.4	4.8
ChB---------------------- Chelsea	57	21	---	2.0	4.0
ChC---------------------- Chelsea	---	---	---	1.5	3.0
ChD---------------------- Chelsea	---	---	---	1.3	2.6
Ck----------------------- Cohoctah	100	35	40	3.5	7.0
CoA---------------------- Coupee	95	33	48	3.1	6.2
CoB---------------------- Coupee	95	33	48	3.1	6.2
Du**. Duneland					
Ed----------------------- Edwards	90	34	---	---	---
EsA, EsB----------------- Elston	95	33	43	3.1	6.2
Fh**. Fluvaquents					
Gf----------------------- Gilford	120	42	54	4.0	8.0
HaA---------------------- Hanna	105	37	42	3.4	6.8
Hh----------------------- Histosols and Aquolls	---	---	---	---	---
Hk----------------------- Homer	100	35	50	3.3	6.6
Hm----------------------- Houghton	---	---	---	---	---

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
Ho------------------------ Houghton	115	34	---	---	---
Md------------------------ Martisco	90	---	---	---	---
Mm------------------------ Maumee	110	38	50	3.6	7.2
Mn------------------------ Maumee Variant	110	38	50	3.6	7.2
Mp------------------------ Milford	131	48	56	5.0	10.0
MrB2---------------------- Morley	102	35	47	4.3	8.6
MrC2---------------------- Morley	100	34	46	4.2	8.4
MrD2---------------------- Morley	90	---	41	3.7	7.4
Mx------------------------ Morocco	80	28	36	2.6	5.2
Mz------------------------ Muskego	90	35	---	3.5	7.0
Nf------------------------ Newton	100	35	45	3.3	6.6
OaC----------------------- Oakville	---	---	---	1.8	3.6
OaE----------------------- Oakville	---	---	---	---	---
Pa------------------------ Palms	105	42	---	---	---
Pe------------------------ Pewamo	125	4.2	60	5.0	10.0
Ph------------------------ Pinhook	115	40	46	3.8	7.6
Qu------------------------ Quinn	110	38	44	3.6	7.2
RlA----------------------- Riddles	120	42	48	4.0	8.0
RlB2---------------------- Riddles	115	40	46	3.8	7.6
RlC2---------------------- Riddles	105	37	42	3.4	6.8
RlD2---------------------- Riddles	90	32	36	3.0	6.0
RlF----------------------- Riddles	---	---	28	1.8	3.6
Sa------------------------ Saugatuck-Pipestone	60	---	27	2.1	4.2

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
Sb Sebewa	105	36	50	4.6	9.2
SeA Selfridge	90	33	42	3.2	6.4
SeB Selfridge	85	30	38	3.0	6.0
So Suman	120	42	45	4.6	9.2
TcA Tracy	105	37	42	3.4	6.8
TcB Tracy	105	37	42	3.4	6.8
TcC2 Tracy	90	32	36	3.0	6.0
TcD2 Tracy	75	26	30	2.5	5.0
TcF. Tracy					
Tr Troxel	148	45	---	5.0	10.0
TyA Tyner	70	24	32	2.3	4.6
Ua**. Udorthents					
Uc Urban land-Coupee	---	---	---	---	---
UoC Urban land-Oakville	---	---	---	---	---
Uv Urban land-Morocco	---	---	---	---	---
Wa Wallkill	100	---	---	3.5	6.5
We Warners	100	30	---	3.0	6.0
Wh Washtenaw	130	46	52	4.3	8.6

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	18,950	---	---	---
II	210,668	53,292	96,817	60,559
III	60,198	21,130	32,064	7,004
IV	64,204	8,949	21,129	34,126
V	10,079	---	10,079	---
VI	5,331	1,790	---	3,541
VII	2,958	---	---	2,958
VIII	5,214	---	5,214	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
Ad: Adrian	4w	Slight	Severe	Severe	Severe	White ash	51	
						Red maple	51	
						Quaking aspen	56	
						Black willow	---	
						Silver maple	76	
BaA: Blount	3c	Slight	Slight	Severe	Severe	White oak	65	Eastern white pine, red pine, yellow-poplar.
						Northern red oak	65	
						Green ash	---	
						Bur oak	---	
						Pin oak	---	
Br: Bourbon	3o	Slight	Slight	Slight	Slight	White oak	70	Eastern white pine, European larch, red maple, American sycamore.
						Pin oak	90	
						Eastern white pine	70	
						Quaking aspen	85	
BtA: Brems	3s	Slight	Slight	Severe	Slight	Northern red oak	70	Eastern white pine, red pine, jack pine.
						Red pine	72	
						Eastern white pine	65	
						Jack pine	70	
Cd: Cheektowaga	5w	Slight	Severe	Severe	Severe	Red maple	50	Northern white-cedar.
						Northern white-cedar	50	
ChB, ChC: Chelsea	3s	Slight	Slight	Moderate	Slight	White oak	70	Eastern white pine, red pine, jack pine.
						Red pine	72	
						Eastern white pine	83	
						Jack pine	70	
						Quaking aspen	72	
						Northern red oak	70	
ChD: Chelsea	3s	Moderate	Moderate	Moderate	Slight	White oak	70	Eastern white pine, red pine, jack pine.
						Red pine	72	
						Eastern white pine	83	
						Jack pine	70	
						Quaking aspen	72	
						Northern red oak	70	
Ck: Cohoctah	2w	Slight	Severe	Severe	Severe	Red maple	72	Eastern white pine, white ash, green ash, red maple.
						Silver maple	95	
						White ash	72	
						Green ash	70	
						Eastern cottonwood	---	
CoA, CoB: Coupee	---	---	---	---	---		---	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
Ed: Edwards	4w	Slight	Severe	Severe	Severe	White ash	51	
						Red maple	51	
						Quaking aspen	56	
						Black willow	---	
						Silver maple	76	
Gf: Gilford	4w	Slight	Severe	Severe	Severe	Pin oak	70	Eastern white pine, European larch, white ash.
						Eastern white pine	55	
						Bigtooth aspen	70	
						Red maple	60	
HaA: Hanna	1o	Slight	Slight	Slight	Slight	Northern red oak	90	Eastern white pine, red pine, black walnut, white ash, yellow-poplar.
						White oak	90	
						Yellow-poplar	98	
						White ash	---	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
Hk----------------- Homer	3o	Slight	Slight	Slight	Slight	White oak-----------	70	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak-------------	85	
						Yellow-poplar--------	85	
Hm, Ho------------- Houghton	4w	Slight	Severe	Severe	Severe	White ash-----------	51	
						Red maple-----------	51	
						Quaking aspen--------	56	
						Black willow--------	---	
						Silver maple--------	76	
Md----------------- Martisco	4w	Slight	Severe	Severe	Severe	Red maple-----------	55	
Mm----------------- Maumee	4w	Slight	Severe	Slight	Severe	Pin oak-------------	70	European larch, silver maple, pin oak.
						Eastern white pine--	55	
						Bigtooth aspen------	70	
						Silver maple--------	80	
Mn----------------- Maumee Variant	4w	Slight	Severe	Severe	Severe	Pin oak-------------	70	European larch, silver maple, pin oak.
						Eastern white pine--	75	
						Bigtooth aspen------	70	
						Silver maple--------	80	
						Quaking aspen--------	---	
Mp----------------- Milford	---	--------	--------	--------	--------		---	Pin oak, green ash, red maple.
MrB2, MrC2--------- Morley	2o	Slight	Slight	Slight	Slight	White oak-----------	80	White oak, black walnut, green ash, eastern white pine, red pine, northern red oak.
						Northern red oak----	80	
						Yellow-poplar--------	90	
						Black walnut--------	---	
						Bur oak-------------	---	
						Northern red oak----	---	
						Shagbark hickory----	---	
						Bur oak-------------	---	
MrD2--------------- Morley	2r	Moderate	Moderate	Moderate	Slight	White oak-----------	80	White oak, black walnut, green ash, eastern white pine, red pine, northern red oak.
						Northern red oak----	80	
						Yellow-poplar--------	90	
						Black walnut--------	---	
						Bur oak-------------	---	
						Shagbark hickory----	---	
						Bur oak-------------	---	
Mx----------------- Morocco	3o	Slight	Slight	Slight	Slight	Northern red oak----	70	Eastern white pine, European larch, red maple, American sycamore, northern red oak.
						Pin oak-------------	85	
						Eastern white pine--	65	
Mz----------------- Muskego	4w	Slight	Severe	Severe	Severe	Tamarack------------	50	
						Red maple-----------	51	
						White ash-----------	52	
						Green ash-----------	---	
						Black willow--------	---	
						Quaking aspen--------	56	
						Silver maple--------	---	
Nf----------------- Newton	4w	Slight	Severe	Severe	Severe	Pin oak-------------	70	Eastern white pine, pin oak, eastern cottonwood, European larch.
						Eastern white pine--	55	
						Eastern cottonwood--	70	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
OaC----------------- Oakville	3s	Slight	Slight	Severe	Slight	White oak----------- Red pine------------ Eastern white pine-- Jack pine-----------	70 78 85 68	Eastern white pine, red pine, jack pine.
OaE----------------- Oakville	3s	Moderate	Severe	Severe	Slight	White oak----------- Red pine------------ Eastern white pine-- Jack pine-----------	70 78 85 68	Eastern white pine, red pine, jack pine.
Pa------------------ Palms	4w	Slight	Severe	Severe	Severe	White ash----------- Red maple----------- Quaking aspen------- Black willow-------- Silver maple--------	51 51 56 --- 76	
Pe------------------ Pewamo	2w	Slight	Severe	Moderate	Moderate	Pin oak------------- Swamp white oak----- Red maple----------- White ash----------- Eastern cottonwood-- Green ash-----------	90 --- 71 71 98 ---	White ash, red maple, green ash, pin oak, eastern cottonwood.
Ph------------------ Pinhook	2w	Slight	Severe	Moderate	Moderate	Pin oak------------- White oak-----------	86 75	Eastern white pine, red maple, white ash, pin oak.
Qu------------------ Quinn	2w	Slight	Severe	Severe	Severe	Pin oak------------- White oak-----------	86 75	Eastern white pine, red maple, white ash.
R1A, R1B2, R1C2, R1D2, R1F---------- Riddles	1o	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Northern red oak----	90 98 90	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, white oak.
Sa*: Saugatuck----------	5w	Slight	Severe	Severe	Moderate	Quaking aspen------- Black willow-------- Red maple----------- White ash----------- Green ash-----------	50 --- 46 45 45	
Pipestone----------	3s	Slight	Slight	Moderate	Slight	Pin oak------------- Northern red oak---- Eastern white pine-- Quaking aspen------- White ash-----------	85 70 65 --- ---	Eastern white pine, eastern cottonwood, red maple, European larch, red pine.
Sb------------------ Sebewa	2w	Slight	Severe	Severe	Severe	Pin oak------------- White ash----------- White oak----------- Red maple----------- American basswood---	88 75 72 --- ---	Eastern white pine, white ash, green ash, pin oak.
SeA, SeB------------ Selfridge	3s	Slight	Slight	Moderate	Slight	Quaking aspen------- Eastern cottonwood-- Black oak----------- Red maple-----------	70 90 --- ---	Eastern white pine, Austrian pine, red pine, black cherry.
So------------------ Suman	2w	Slight	Severe	Severe	Severe	Pin oak------------- Red maple----------- Swamp white oak----- White ash-----------	86 --- --- ---	Eastern white pine, red maple, white ash, pin oak.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
TcA, TcB, TcC2, TcD2, TcF: Tracy	1o	Slight	Slight	Slight	Slight	Northern red oak White oak Yellow-poplar	90 90 98	Eastern white pine, red pine, black walnut, black locust, white ash, yellow-poplar.
Tr*: Troxel	---	---	---	---	---		--- ---	White oak, black walnut, northern red oak, green ash, eastern white pine.
TyA: Tyner	3s	Slight	Slight	Moderate	Slight	White oak Red pine Eastern white pine Jack pine Quaking aspen Northern red oak	70 72 65 70 72 70	Eastern white pine, red pine, jack pine.
Wa: Walkill	4w	Slight	Severe	Severe	Severe	Pin oak Red maple	80 65	
We: Warners	5w	Slight	Severe	Severe	Severe	Red maple	55	
Wh: Washtenaw	2w	Slight	Severe	Severe	Moderate	Pin oak Northern red oak Red maple Silver maple White ash American basswood White oak	86 75 70 --- --- --- ---	Eastern white pine, red maple, white ash.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ad------------------ Adrian	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Black willow, golden willow.	Imperial Carolina poplar.
BaA----------------- Blount	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
Br------------------ Bourbon	Gray dogwood, dwarf purple willow.	Redosier dogwood, silky dogwood.	Tall purple willow	Eastern white pine, pin oak.	---
BtA----------------- Brems	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine.	Eastern white pine	---
Cd. Cheektowaga					
ChB, ChC------------ Chelsea	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine.	Eastern white pine	---
ChD. Chelsea					
Ck------------------ Cohoctah	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
CoA, CoB------------ Coupee	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Du*. Duneland					
Ed----------------- Edwards	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
EsA, EsB----------- Elston	---	Eastern redcedar, Amur honeysuckle, Amur privet, American cranberrybush, Washington hawthorn, Tatarian honeysuckle.	Austrian pine, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
Fh*. Fluvaquents					
Gf----------------- Gilford	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, northern white-cedar, Washington hawthorn, blue spruce, white fir, Austrian pine.	Eastern white pine	Pin oak.
HaA---------------- Hanna	---	Amur privet, Washington hawthorn, Amur honeysuckle, American cranberrybush, Tatarian honeysuckle.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
Hh*: Histosols.					
Aquolls.					
Hk----------------- Homer	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce------	Eastern white pine, pin oak.
Hm, Ho------------- Houghton	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Md. Martisco					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Mm----------------- Maumee	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Mn----------------- Maumee Variant	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
Mp----------------- Milford	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
MrB2, MrC2, MrD2-- Morley	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
Mx----------------- Morocco	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Mz----------------- Muskego	Common ninebark, whitebelle honeysuckle.	Amur privet, nannyberry viburnum, silky dogwood, Tatarian honeysuckle, Amur honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Nf----------------- Newton	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
OaC, OaE----------- Oakville	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Pa: Palms	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Pe: Pewamo	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Ph: Pinhook	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Qu: Quinn	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
RlA, RlB2, RlC2, RlD2, RlF: Riddles	---	Amur privet, Amur honeysuckle, American cranberrybush, Washington hawthorn, Tatarian honeysuckle.	Eastern redcedar, Austrian pine, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
Sa*:					
Saugatuck	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Pipestone	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Sb: Sebewa	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
SeA, SeB: Selfridge	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
So: Suman	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
TcA, TcB, TcC2, TcD2, TcF: Tracy	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Tr: Troxel	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
TyA: Tyner	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine.	Eastern white pine	---
Ua*. Udorthents					
Uc*: Urban land.					
Coupee	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
UoC*: Urban land.					
Oakville	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---
Uv*: Urban land.					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Uv*:					
Morocco----------	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Wa---------------- Wallkill	Dwarf purple willow, gray dogwood.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	---
We. Warners					
Wh---------------- Washtenaw	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ad--------------------- Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
BaA-------------------- Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
Br--------------------- Bourbon	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BtA-------------------- Brems	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
Cd--------------------- Cheektowaga	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
ChB-------------------- Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
ChC-------------------- Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: too sandy, slope.	Severe: too sandy.	Moderate: slope, droughty.
ChD-------------------- Chelsea	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: too sandy.	Severe: slope.
Ck--------------------- Cohoctah	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
CoA-------------------- Coupee	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
CoB-------------------- Coupee	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
Du*. Duneland					
Ed--------------------- Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
EsA-------------------- Elston	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
EsB-------------------- Elston	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
Fh*. Fluvaquents					
Gf--------------------- Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
HaA-------------------- Hanna	Slight----------	Slight----------	Moderate: small stones.	Slight------------	Slight.
Hh*: Histosols.					

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Hh*: Aquolls.					
Hk------------------- Homer	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
Hm, Ho--------------- Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Md------------------- Martisco	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Mm------------------- Maumee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Mn------------------- Maumee Variant	Severe: floods, ponding.	Severe: ponding.	Severe: ponding, floods.	Severe: ponding.	Severe: ponding, floods.
Mp------------------- Milford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MrB2----------------- Morley	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
MrC2----------------- Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
MrD2----------------- Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Mx------------------- Morocco	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Mz------------------- Muskego	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
Nf------------------- Newton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
OaC------------------ Oakville	Severe: too sandy.	Severe: too sandy.	Severe: slope. too sandy.	Severe: too sandy.	Moderate: slope, droughty.
OaE------------------ Oakville	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
Pa------------------- Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Pe------------------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Ph------------------- Pinhook	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Qu------------------- Quinn	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RlA: Riddles	Slight	Slight	Moderate: small stones.	Slight	Slight.
RlB2: Riddles	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
RlC2: Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
RlD2: Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
RlF: Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sa*:					
Saugatuck	Severe: ponding, cemented pan.	Severe: ponding, cemented pan.	Severe: ponding, cemented pan.	Severe: ponding.	Severe: ponding, thin layer.
Pipestone	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Sb: Sebewa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
SeA, SeB: Selfridge	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
So: Suman	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
TcA: Tracy	Slight	Slight	Moderate: small stones.	Slight	Slight.
TcB: Tracy	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
TcC2: Tracy	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
TcD2: Tracy	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
TcF: Tracy	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tr: Troxel	Severe: floods.	Slight	Moderate: floods.	Slight	Moderate: floods.
TyA: Tyner	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
Ua*. Udorthents					
Uc*: Urban land.					
Coupee	Slight	Slight	Slight	Slight	Slight.
UoC*: Urban land.					

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
UoC*:					
Oakville	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
Uv*:					
Urban land.					
Morocco	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Wa Wallkill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
We Warners	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Wh Washtenaw	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ad----------------- Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
BaA---------------- Blount	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Br----------------- Bourbon	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BtA---------------- Brems	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor.
Cd----------------- Cheektowaga	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
ChB---------------- Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
ChC, ChD----------- Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Ck----------------- Cohoctah	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
CoA---------------- Coupee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CoB---------------- Coupee	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Du*. Duneland										
Ed----------------- Edwards	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
EsA, EsB----------- Elston	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Fh*. Fluvaquents										
Gf----------------- Gilford	Fair	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
HaA---------------- Hanna	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Hh*: Histosols.										
Aquolls.										
Hk----------------- Homer	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Hm, Ho------------- Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Md----------------- Martisco	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Mm: Maumee	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Mn: Maumee Variant	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Mp: Milford	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
MrB2: Morley	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
MrC2: Morley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MrD2: Morley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Mx: Morocco	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Fair	Fair	Poor.
Mz: Muskego	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good.
Nf: Newton	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
OaC, OaE: Oakville	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Pa: Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Poor.
Pe: Pewamo	Good	Fair	Fair	Fair	Fair	---	Good	Fair	Fair	Good.
Ph: Pinhook	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
Qu: Quinn	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
RlA, RlB2: Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RlC2: Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
RlD2: Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
RlF: Riddles	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Sa*:										
Saugatuck	Poor	Poor	Fair	Poor	Poor	Good	Good	Poor	Poor	Poor.
Pipestone	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor.
Sb: Sebewa	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
SeA: Selfridge	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
SeB------------------ Selfridge	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
So------------------ Suman	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
TcA, TcB------------ Tracy	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
TcC2---------------- Tracy	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
TcD2---------------- Tracy	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
TcF. Tracy										
Tr------------------ Troxel	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
TyA----------------- Tyner	Fair	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Ua*. Udorthents										
Uc*: Urban land.										
Coupee--------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
UoC*: Urban land.										
Oakville------------	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Uv*: Urban land.										
Morocco-------------	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Fair	Fair	Poor.
Wa------------------ Wallkill	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
We------------------ Warners	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wh------------------ Washtenaw	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ad----------------- Adrian	Severe: ponding, cutbanks cave, excess humus.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
BaA---------------- Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Br----------------- Bourbon	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
BtA---------------- Brems	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
Cd----------------- Cheektowaga	Severe: ponding, too clayey.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
ChB---------------- Chelsea	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Slight-----------	Moderate: droughty.
ChC---------------- Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.
ChD---------------- Chelsea	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ck----------------- Cohoctah	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action, wetness.	Severe: floods, wetness.
CoA---------------- Coupee	Severe: cutbanks cave.	Slight-----------	Slight-----------	Slight-----------	Moderate: low strength.	Slight.
CoB---------------- Coupee	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Moderate: low strength.	Slight.
Du*. Duneland						
Ed----------------- Edwards	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.
EsA---------------- Elston	Severe: cutbanks cave.	Slight-----------	Slight-----------	Slight-----------	Slight-----------	Slight.
EsB---------------- Elston	Severe: cutbanks cave.	Slight-----------	Slight-----------	Moderate: slope.	Slight-----------	Slight.
Fh*. Fluvaquents						
Gf----------------- Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
HaA---------------- Hanna	Severe: cutbanks cave.	Slight-----------	Moderate: wetness.	Slight-----------	Severe: frost action.	Slight.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Hh*: Histosols.						
Aquolls.						
Hk------------------ Homer	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Hm, Ho------------ Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
Md------------------ Martisco	Severe: ponding, excess humus.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, low strength, frost action.	Severe: ponding.
Mm------------------ Maumee	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Mn------------------ Maumee Variant	Severe: cutbanks cave, excess humus, ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: floods, ponding.	Severe: ponding, floods, frost action.	Severe: ponding, floods.
Mp------------------ Milford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
MrB2---------------- Morley	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
MrC2---------------- Morley	Moderate: too clayey, dense layer, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
MrD2---------------- Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Mx------------------ Morocco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Mz------------------ Muskego	Severe: excess humus, ponding.	Severe: low strength, ponding.	Severe: low strength, ponding.	Severe: low strength, ponding.	Severe: frost action, low strength, ponding.	Severe: excess humus, ponding.
Nf------------------ Newton	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
OaC----------------- Oakville	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.
OaE----------------- Oakville	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Pa Palms	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: ponding, excess humus.
Pe Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Ph Pinhook	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Qu Quinn	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
RlA Riddles	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
RlB2 Riddles	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
RlC2 Riddles	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
RlD2, RlF Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sa*:						
Saugatuck	Severe: ponding, cutbanks cave, cemented pan.	Severe: ponding.	Severe: ponding, cemented pan.	Severe: ponding.	Severe: ponding.	Severe: ponding, thin layer.
Pipestone	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Sb Sebewa	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
SeA, SeB Selfridge	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
So Suman	Severe: cutbanks cave, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: wetness, floods.
TcA Tracy	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
TcB Tracy	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
TcC2 Tracy	Severe: cutbanks cave,	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
TcD2, TcF Tracy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Tr: Troxel	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods, frost action.	Moderate: floods.
TyA: Tyner	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Ua*. Udorthents						
Uc*: Urban land.						
Coupee	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.	Slight.
UoC*: Urban land.						
Oakville	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Uv*: Urban land.						
Morocco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Wa: Wallkill	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding.
We: Warners	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Wh: Washtenaw	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ad------------------ Adrian	Severe: ponding, poor filter.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
BaA----------------- Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Br------------------ Bourbon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
BtA----------------- Brems	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Cd------------------ Cheektowaga	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding, seepage.	Poor: ponding.
ChB----------------- Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
ChC----------------- Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
ChD----------------- Chelsea	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
Ck------------------ Cohoctah	Severe: wetness, floods.	Severe: floods, seepage, wetness.	Severe: seepage, floods, wetness.	Severe: seepage, floods, wetness.	Poor: wetness.
CoA, CoB------------ Coupee	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Du*. Duneland					
Ed------------------ Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.
EsA, EsB------------ Elston	Slight------------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Fh*. Fluvaquents					
Gf------------------ Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HaA----------------- Hanna	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Hh*: Histosols.					
Aquolls.					
Hk------------------ Homer	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
Hm, Ho-------------- Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Md------------------ Martisco	Severe: ponding, percs slowly.	Severe: ponding, excess humus.	Severe: ponding.	Severe: ponding.	Poor: ponding. excess humus.
Mm------------------ Maumee	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, too sandy, ponding.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Mn------------------ Maumee Variant	Severe: floods, ponding, poor filter.	Severe: seepage, floods, excess humus.	Severe: floods, seepage, ponding.	Severe: floods, seepage, ponding.	Poor: seepage, too sandy, ponding.
Mp------------------ Milford	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
MrB2---------------- Morley	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Slight-----------	Fair: too clayey, wetness.
MrC2---------------- Morley	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, wetness.
MrD2---------------- Morley	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
Mx------------------ Morocco	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
Mz------------------ Muskego	Severe: percs slowly, ponding.	Severe: seepage, excess humus, ponding.	Severe: excess humus, ponding.	Severe: seepage, ponding.	Poor: hard to pack, ponding.
Nf------------------ Newton	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: too sandy, seepage, ponding.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OaC: Oakville	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
OaE: Oakville	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
Pa: Palms	Severe: percs slowly, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Pe: Pewamo	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
Ph: Pinhook	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
Qu: Quinn	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness.	Poor: wetness.
RlA: Riddles	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
RlB2: Riddles	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
RlC2: Riddles	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
RlD2, RlF: Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Sa*:					
Saugatuck	Severe: cemented pan, ponding, percs slowly.	Severe: ponding, seepage, cemented pan.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding, cemented pan.	Poor: too sandy, seepage, area reclaim.
Pipestone	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage, wetness.
Sb: Sebewa	Severe: poor filter, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: small stones, seepage, too sandy.
SeA, SeB: Selfridge	Severe: percs slowly, wetness.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
So: Suman	Severe: floods, wetness, percs slowly.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: wetness, seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
TcA----------------- Tracy	Slight-----------	Moderate: seepage.	Severe: seepage.	Slight-----------	Good.
TcB----------------- Tracy	Slight-----------	Moderate: seepage, slope.	Severe: seepage.	Slight-----------	Good.
TcC2---------------- Tracy	Moderate: slope.	Severe: slope.	Severe: seepage.	Moderate: slope.	Fair: slope.
TcD2, TcF----------- Tracy	Severe: slope.	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
Tr------------------ Troxel	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Good.
TyA----------------- Tyner	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Ua*. Udorthents					
Uc*: Urban land.					
Coupee--------------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
UoC*: Urban land.					
Oakville------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Uv*: Urban land.					
Morocco-------------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
Wa------------------ Wallkill	Severe: ponding.	Severe: ponding, seepage.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding.
We------------------ Warners	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Wh------------------ Washtenaw	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ad: Adrian	Poor: wetness, low strength.	Probable	Improbable: too sandy.	Poor: wetness, excess humus.
BaA: Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Br: Bourbon	Fair: wetness.	Probable	Improbable: too sandy.	Good.
BtA: Brems	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Cd: Cheektowaga	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
ChB, ChC: Chelsea	Good	Probable	Improbable: too sandy.	Poor: too sandy.
ChD: Chelsea	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Ck: Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
CoA, CoB: Coupee	Good	Probable	Probable	Fair: thin layer, small stones, area reclaim.
Du*. Duneland				
Ed: Edwards	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
EsA, EsB: Elston	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim.
Fh*. Fluvaquents				
Gf: Gilford	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
HaA: Hanna	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
Hh*: Histosols.				
Aquolls.				
Hk: Homer	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Hm, Ho: Houghton	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
Md: Martisco	Poor: wetness, excess humus.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Mm: Maumee	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Mn: Maumee Variant	Poor: wetness.	Probable	Improbable: too sandy.	Poor: thin layer, wetness.
Mp: Milford	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
MrB2, MrC2: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
MrD2: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Mx: Morocco	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
Mz: Muskego	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
Nf: Newton	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
OaC: Oakville	Good	Probable	Improbable: too sandy.	Poor: too sandy.
OaE: Oakville	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Pa: Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
Pe: Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ph: Pinhook	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness, small stones.
Qu: Quinn	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
RlA, RlB2: Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
RlC2: Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
RlD2: Riddles	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RlF: Riddles	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Sa*:				
Saugatuck	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness, area reclaim.
Pipestone	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Sb: Sebewa	Poor: wetness.	Probable	Probable	Poor: wetness, small stones, area reclaim.
SeA, SeB: Selfridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, area reclaim, small stones.
So: Suman	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
TcA, TcB: Tracy	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim.
TcC2: Tracy	Good	Probable	Improbable: too sandy.	Fair: slope, small stones, area reclaim.
TcD2: Tracy	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
TcF: Tracy	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Tr: Troxel	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
TyA: Tyner	Good	Probable	Improbable: too sandy.	Poor: thin layer.
Ua*. Udorthents				
Uc*:				
Urban land.				
Coupee	Good	Probable	Probable	Fair: thin layer, small stones, area reclaim.
UoC*:				
Urban land.				
Oakville	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Uv*:				
Urban land.				
Morocco	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Wa: Wallkill	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
We: Warners	Poor: wetness, frost action.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wh: Washtenaw	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Ad----------------- Adrian	Severe: seepage.	Severe: seepage, ponding, excess humus.	Ponding, frost action, subsides.	Ponding, soil blowing.	Ponding, soil blowing, too sandy.	Wetness.
BaA---------------- Blount	Slight----------	Moderate: piping, wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
Br----------------- Bourbon	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, soil blowing, too sandy.	Wetness.
BtA---------------- Brems	Severe: seepage.	Severe: seepage, piping.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
Cd----------------- Cheektowaga	Severe: seepage.	Severe: ponding.	Percs slowly, poor outlets, ponding.	Ponding---------	Ponding---------	Wetness.
ChB---------------- Chelsea	Severe: seepage.	Severe: piping, seepage.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
ChC, ChD----------- Chelsea	Severe: slope, seepage.	Severe: piping, seepage.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Ck----------------- Cohoctah	Severe: seepage.	Severe: piping, wetness.	Floods, frost action.	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
CoA---------------- Coupee	Severe: seepage.	Severe: thin layer.	Deep to water	Favorable-------	Favorable-------	Favorable.
CoB---------------- Coupee	Severe: seepage.	Severe: thin layer.	Deep to water	Slope-----------	Favorable-------	Favorable.
Du*. Duneland						
Ed----------------- Edwards	Severe: seepage.	Severe: ponding.	Frost action, ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
EsA---------------- Elston	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable-------	Too sandy-------	Favorable.
EsB---------------- Elston	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope-----------	Too sandy-------	Favorable.
Fh*. Fluvaquents						
Gf----------------- Gilford	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
HaA---------------- Hanna	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing----	Too sandy, soil blowing.	Favorable.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Hh*: Histosols.						
Aquolls.						
Hk-----Homer	Severe: seepage.	Severe: seepage, wetness.	Frost action, cutbanks cave.	Wetness-----	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
Hm, Ho-----Houghton	Severe: seepage.	Severe: excess humus, ponding.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowing.	Wetness.
Md-----Martisco	Severe: seepage.	Severe: ponding.	Percs slowly, poor outlets, ponding.	Ponding-----	Ponding-----	Wetness.
Mm-----Maumee	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
Mn-----Maumee Variant	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, floods, frost action.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
Mp-----Milford	Slight-----	Severe: ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
MrB2-----Morley	Moderate: slope.	Moderate: piping.	Deep to water	Percs slowly, rooting depth, slope.	Erodes easily	Erodes easily, rooting depth.
MrC2, MrD2-----Morley	Severe: slope.	Moderate: piping.	Deep to water	Percs slowly, rooting depth, slope.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
Mx-----Morocco	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Droughty, fast intake, wetness.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Mz-----Muskego	Severe: seepage.	Severe: excess humus, ponding.	Percs slowly, subsides, ponding.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
Nf-----Newton	Severe: seepage.	Severe: piping, seepage, ponding.	Ponding, cutbanks cave.	Fast intake, droughty, ponding.	Ponding, too sandy, soil blowing.	Wetness, droughty.
OaC, OaE-----Oakville	Severe: seepage, slope.	Severe: piping, seepage.	Deep to water	Fast intake, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Pa-----Palms	Severe: seepage.	Severe: excess humus, ponding.	Frost action, ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
Pe-----Pewamo	Slight-----	Severe: ponding.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.
Ph-----Pinhook	Severe: seepage.	Severe: wetness, piping.	Frost action, cutbanks cave.	Wetness-----	Wetness-----	Wetness.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Qu----------------- Quinn	Moderate: seepage.	Severe: piping, wetness.	Frost action---	Wetness--------	Wetness--------	Wetness.
R1A---------------- Riddles	Moderate: seepage.	Slight---------	Deep to water	Favorable------	Favorable------	Favorable.
R1B2--------------- Riddles	Moderate: seepage, slope.	Slight---------	Deep to water	Slope----------	Favorable------	Favorable.
R1C2, R1D2, R1F--- Riddles	Severe: slope.	Slight---------	Deep to water	Slope----------	Slope----------	Slope.
Sa*: Saugatuck--------	Severe: seepage, cemented pan.	Severe: seepage, ponding, piping.	Percs slowly, cemented pan, ponding.	Fast intake, ponding, droughty.	Too sandy, cemented pan, ponding.	Wetness, droughty, cemented pan.
Pipestone--------	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Fast intake, wetness, droughty.	Too sandy, soil blowing, wetness.	Droughty, wetness.
Sb----------------- Sebewa	Severe: seepage.	Severe: seepage, ponding.	Frost action, cutbanks cave, ponding.	Ponding--------	Too sandy, ponding.	Wetness.
SeA---------------- Selfridge	Severe: seepage.	Severe: wetness.	Frost action---	Wetness, fast intake, soil blowing.	Wetness, soil blowing, erodes easily.	Wetness, erodes easily.
SeB---------------- Selfridge	Severe: seepage.	Severe: wetness.	Slope, frost action.	Wetness, fast intake, soil blowing.	Wetness, soil blowing, erodes easily.	Wetness, erodes easily.
So----------------- Suman	Severe: seepage.	Severe: seepage, wetness, piping.	Floods, frost action, cutbanks cave.	Wetness, floods.	Wetness, too sandy.	Wetness.
TcA---------------- Tracy	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
TcB---------------- Tracy	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
TcC2, TcD2, TcF--- Tracy	Severe: slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Slope, soil blowing.	Slope.
Tr----------------- Troxel	Moderate: seepage.	Severe: piping.	Deep to water	Floods---------	Favorable------	Favorable.
TyA---------------- Tyner	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing, droughty.	Too sandy, soil blowing.	Droughty.
Ua*. Udorthents						
Uc*: Urban land.						
Coupee-----------	Severe: seepage.	Severe: thin layer.	Deep to water	Favorable------	Favorable------	Favorable.
UoC*: Urban land.						

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
UoC*:						
Oakville	Severe: seepage.	Severe: piping, seepage.	Deep to water	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Uv*:						
Urban land.						
Morocco	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Droughty, fast intake, wetness.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Wa: Wallkill	Severe: seepage.	Severe: excess humus, ponding.	Ponding, poor outlets, frost action.	Ponding	Ponding	Wetness.
We: Warners	Severe: seepage.	Severe: ponding.	Ponding, poor outlets.	Ponding	Ponding	Wetness.
Wh: Washtenaw	Moderate: seepage.	Severe: piping, ponding.	Percs slowly, frost action, ponding.	Ponding, percs slowly, erodes easily.	Ponding, erodes easily.	Wetness, percs slowly, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ad----------------- Adrian	0-32	Sapric material	PT	A-8	---	---	---	---	---	---	---
	32-60	Sand, loamy sand, fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	*NP
BaA---------------- Blount	0-9	Silt loam----------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	9-42	Silty clay loam, silty clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	90-100	80-95	35-60	15-35
	42-60	Silty clay loam, clay loam.	CL	A-6	0-10	90-100	90-100	80-100	70-90	25-40	10-25
Br----------------- Bourbon	0-9	Sandy loam---------	SM, SM-SC	A-2, A-4	0-5	95-100	75-99	40-65	15-40	<25	NP-7
	9-16	Sandy loam, sandy clay loam, shaly sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	90-100	75-99	45-80	20-45	15-35	2-16
	16-41	Loamy sand, sandy loam, shaly sandy loam.	SM	A-2, A-4	0-5	80-100	75-99	40-70	15-40	---	NP
	41-60	Stratified coarse sand to shaly sand.	SP, SP-SM, SM	A-1, A-3	0-5	75-90	45-85	40-70	3-15	---	NP
BtA---------------- Brems	0-9	Fine sand----------	SM, SP-SM	A-2-4, A-3	0	100	85-100	50-85	5-15	---	NP
	9-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
Cd----------------- Cheektowaga	0-13	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	95-100	55-85	25-55	25-35	5-10
	13-30	Loamy fine sand, fine sand, sand. fine sand, sand.	SM, SW-SM	A-1, A-2, A-3 A-3	0	100	95-100	45-80	5-40	---	NP
	30-60	Silty clay, clay, silty clay loam.	CL	A-6, A-4	0	100	95-100	90-100	75-95	25-40	10-20
ChB, ChC, ChD----- Chelsea	0-7	Fine sand----------	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	7-80	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
Ck----------------- Cohoctah	0-18	Sandy loam---------	ML, SM	A-4, A-2	0	100	100	65-95	30-75	<30	NP-6
	18-60	Loam, sandy loam, loamy sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	65-90	20-70	<30	NP-10
CoA, CoB----------- Coupee	0-16	Silt loam----------	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	60-85	25-35	5-15
	16-37	Loam, clay loam, sandy clay loam.	CL, SC	A-6	0	96-98	80-95	70-95	40-90	30-40	11-20
	37-45	Stratified loamy sand to sand.	SM, SP-SM	A-3, A-2-4	0-3	88-95	80-85	50-70	5-15	---	NP
	45-60	Sand and shaly sand.	SW, GP, SW-SM, GP-GM	A-1-A	0-5	45-60	30-40	15-20	2-10	---	NP
Du**. Duneland											
Ed----------------- Edwards	0-22	Sapric material	PT	A-8	0	---	---	---	---	---	---
	22-60	Marl---------------	---	---	0	100	95-100	80-90	60-80	---	---

See footnotes at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
EsA, EsB---------- Elston	0-19	Loam--------------	CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	20-35	5-15
	19-26	Sandy loam, loam, sandy clay loam.	SM, CL, SC, ML	A-4, A-6	0	95-100	75-95	50-80	35-65	<30	NP-15
	26-48	Loamy sand, sandy loam.	SP-SM, SM, SC, SM-SC	A-2-4, A-3, A-1-B	0-3	95-100	75-95	45-75	5-30	<25	NP-10
	48-60	Sand--------------	SP-SM, SM	A-3, A-2-4, A-1-B	0-3	95-100	70-95	40-70	5-25	---	NP
Fh**. Fluvaquents											
Gf---------------- Gilford	0-10	Fine sandy loam	SM, SC, SM-SC	A-4	0	95-100	90-100	65-80	35-45	<25	2-10
	10-36	Sandy loam, fine sandy loam.	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	20-35	15-30	NP-8
	36-60	Loamy sand, sand	SM, SP, SP-SM	A-3, A-1-B, A-2-4	0	90-100	85-100	18-60	3-20	---	NP
HaA--------------- Hanna	0-13	Sandy loam--------	SC, SM-SC	A-2-4, A-4	0	95-100	85-100	60-70	30-40	20-30	5-10
	13-31	Loam, sandy loam, clay loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0	85-100	75-95	50-90	35-70	20-30	5-15
	31-65	Stratified sand to sandy loam.	SM, SP-SM	A-2-4, A-3, A-1-B	0	80-100	65-90	40-70	5-15	---	NP
	65-80	Sand, loamy sand	SM, SP-SM	A-2-4, A-3, A-1-B	0-5	80-95	60-90	30-70	5-15	---	NP
Hh**: Histosols.											
Aquolls.											
Hk---------------- Homer	0-10	Loam--------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	70-95	25-35	5-15
	10-22	Silty clay loam, clay loam.	CL	A-6, A-7	0	90-100	90-100	90-100	70-95	30-50	15-30
	22-34	Sandy clay loam, sandy loam.	SC	A-2-6, A-6	0-3	90-100	85-100	75-90	30-50	25-35	10-15
	34-60	Stratified sand to very gravelly sand.	SP, GP, SP-SM, GP-GM	A-1	1-5	30-70	22-55	7-20	2-10	---	NP
Hm, Ho------------ Houghton	0-70	Sapric material	PT	A-8	0	---	---	---	---	---	---
Md---------------- Martisco	0-9	Sapric material	PT	---	0	---	---	---	---	---	---
	9-60	Marl--------------	---	---	0	---	---	---	---	---	---
Mm---------------- Maumee	0-18	Loamy fine sand	SM	A-2-4	0	95-100	90-100	50-75	5-30	<30	NP-5
	18-60	Sand, loamy fine sand.	SP, SP-SM	A-1-B, A-3, A-2-4	0	85-100	75-95	35-70	3-25	<30	NP
Mn---------------- Maumee Variant	0-12	Loamy sand--------	SM, SP-SM	A-2-4	0	100	100	50-75	5-30	<30	NP-5
	12-35	Sand--------------	SP, SP-SM	A-1-B, A-3, A-2-4	0	100	100	50-70	5-12	<30	NP
	35-45	Sapric material	PT	A-8	0	---	---	---	---	---	---
	45-60	Sand--------------	SP, SP-SM	A-1-B, A-3, A-2-4	0	100	100	50-70	5-12	<30	NP

See footnotes at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Mp---------------- Milford	0-17	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	80-95	40-60	20-35
	17-38	Silty clay, silty clay loam, clay loam.	CH, CL	A-7	0	100	95-100	90-100	75-100	40-60	20-40
	38-60	Stratified clay to sandy loam.	CL	A-6, A-7	0	97-100	95-100	90-100	70-100	30-50	15-30
MrB2, MrC2, MrD2- Morley	0-8	Silt loam---------	CL	A-6	0-5	95-100	95-100	90-100	85-95	25-40	10-20
	8-34	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-45	15-25
	34-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-45	10-25
Mx---------------- Morocco	0-6	Loamy fine sand	SM, SM-SC	A-2-4	0	100	100	50-85	15-35	<20	NP-5
	6-60	Fine sand, sand	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
Mz---------------- Muskego	0-16	Sapric material	PT	A-8	0	---	---	---	---	---	---
	16-60	Coprogenous earth	OH, OL	A-8	0	---	---	---	---	---	---
Nf---------------- Newton	0-15	Loamy fine sand	SM, SM-SC	A-2-4	0	100	100	50-75	15-30	<20	NP-5
	15-60	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2-4, A-3	0	100	100	50-75	5-25	---	NP
OaC, OaE---------- Oakville	0-4	Fine sand---------	SM, SP, SP-SM	A-2, A-3	0	100	100	50-85	0-35	---	NP
	4-60	Fine sand---------	SM, SP, SP-SM	A-2, A-3	0	100	95-100	65-95	0-25	---	NP
Pa---------------- Palms	0-24	Sapric material	PT	---	---	---	---	---	---	---	---
	24-60	Clay loam, silty clay loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
Pe---------------- Pewamo	0-10	Silty clay loam	CL	A-6	0-5	95-100	90-100	90-100	70-90	25-40	10-20
	10-39	Clay loam, clay, silty clay.	CL, CH	A-6, A-7	0-5	95-100	90-100	90-100	75-95	35-55	15-30
	39-60	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	90-100	70-90	30-45	14-25
Ph---------------- Pinhook	0-12	Loam--------------	CL, CL-ML	A-4, A-6	0	100	85-95	75-90	50-70	20-30	5-15
	12-39	Sandy loam, loam	SC, CL, SM, ML	A-6, A-4, A-2	0	95-100	65-95	50-90	20-65	15-35	NP-15
	39-60	Stratified shaly sandy loam to sand.	SM, SP-SM, SW-SM	A-3, A-2-4, A-1	0-5	80-100	65-95	35-65	5-25	---	NP
Qu---------------- Quinn	0-8	Loam--------------	CL, CL-ML	A-4, A-6	0	100	90-100	75-95	50-85	22-32	5-12
	8-27	Sandy loam, loam	CL, ML, SM, SC	A-4, A-6	0	95-100	85-95	65-90	40-65	20-35	2-14
	27-60	Loamy sand, sand	SM, SP-SM	A-3, A-2-4	0-5	80-95	70-90	50-70	5-15	---	NP
RlA, RlB2, RlC2, RlD2, RlF-------- Riddles	0-14	Loam--------------	CL	A-4, A-6	0	95-100	85-95	80-90	60-75	20-35	8-15
	14-47	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	47-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
Sa**: Saugatuck---------	0-10	Loamy fine sand	SM	A-2-4	0	100	100	50-70	15-30	---	NP
	10-30	Sand--------------	SP-SM, SM	A-3, A-2-4	0	100	100	80-95	5-15	---	NP
	30-60	Sand--------------	SP, SP-SM	A-3	0	100	100	80-95	0-10	---	NP

See footnotes at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Sa**:											
Pipestone	0-9	Loamy fine sand	SL , SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	9-32	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	32-60	Sand, fine sand	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP
Sb Sebewa	0-9	Loam	CL, CL-ML	A-4, A-6	0	95-100	80-100	75-95	50-90	22-35	6-12
	9-36	Sandy clay loam, loam, gravelly clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	36-60	Sand and gravel	SP, SP-SM, GP, GP-GM	A-1	0-5	40-75	35-70	20-40	0-10	---	NP
SeA, SeB Selfridge	0-22	Loamy sand	SM, SM-SC	A-2	0-5	95-100	95-100	70-85	20-35	<20	NP-5
	22-25	Sandy loam	SM, SC, SM-SC	A-2, A-4	0-5	95-100	95-100	65-80	25-45	15-30	NP-10
	25-60	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
So Suman	0-22	Silty clay loam	CL	A-6, A-7	0	100	90-100	80-95	60-90	35-50	15-30
	22-34	Clay loam, sandy clay loam, loam.	CL	A-6, A-7	0	100	90-100	65-95	50-85	30-50	10-30
	34-60	Sand, coarse sand	SM, SP-SM	A-3, A-2-4, A-1-B	0	100	90-100	40-75	5-25	---	NP
TcA, TcB, TcC2, TcD2, TcF Tracy	0-8	Sandy loam	SM, SC, SM-SC	A-2-4, A-4	0	90-100	85-100	60-70	30-40	20-30	3-10
	8-25	Loam, sandy loam	ML, SM, SC, CL	A-4, A-6	0	95-100	80-95	65-90	35-70	22-33	3-12
	25-46	Stratified shaly sandy clay loam to shaly loamy sand.	SC, SM, SM-SC	A-2-4, A-4	0	95-100	70-85	70-85	25-50	20-30	3-10
	46-60	Stratified loamy sand to shaly sand.	SM, SP-SM	A-1-B, A-3, A-2-4	0-5	80-95	55-85	30-65	5-20	---	NP
Tr Troxel	0-35	Silt loam	CL, CL-ML	A-6, A-4	0	100	100	95-100	85-95	25-40	5-20
	35-47	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-95	70-95	30-50	15-30
	47-80	Stratified silty clay loam to gravelly loamy sand.	SM-SC, CL, SC, CL-ML	A-4, A-6, A-2	0	85-100	80-100	70-95	30-80	25-40	5-20
TyA Tyner	0-13	Loamy sand	SM	A-2-4	0	90-100	85-95	50-75	15-25	---	NP
	13-40	Sand, loamy sand, loamy fine sand.	SM, SP-SM	A-2-4	0	90-100	85-95	50-70	10-30	---	NP
	40-60	Fine sand, sand, loamy sand.	SM, SP-SM	A-3, A-2-4	0-5	80-95	75-95	50-70	5-25	---	NP
Ua**. Udorthents											
Uc**: Urban land.											
Coupee	0-16	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-95	60-85	25-35	5-15
	16-37	Silt loam, clay loam, sandy clay loam.	CL, SC	A-6	0	96-98	80-95	70-95	40-90	30-40	11-20
	37-45	Stratified loamy sand to sand.	SM, SP-SM	A-3, A-2-4	0-3	88-95	80-85	50-70	5-15	---	NP
	45-60	Sand and gravel	SW, GP, SW-SM, GP-GM	A-1-A	0-5	45-60	30-40	15-20	2-10	---	NP

See footnotes at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
UoC**: Urban land.											
Oakville----------	0-4	Fine sand---------	SM, SP, SP-SM	A-2, A-3	0	100	100	50-85	0-35	---	NP
	4-60	Fine sand---------	SM, SP, SP-SM	A-2, A-3	0	100	95-100	65-95	0-25	---	NP
Uv**: Urban land.											
Morocco----------	0-6	Loamy fine sand	SM, SM-SC	A-2-4	0	100	100	50-85	15-35	<20	NP-5
	6-60	Fine sand, sand	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
Wa---------------- Wallkill	0-10	Silt loam---------	ML, SM, OL	A-5, A-7	0	95-100	90-100	70-100	40-90	40-50	5-15
	10-27	Silt loam, loam, gravelly silt loam.	CL, CL-ML, SM-SC, SC	A-4	0	75-100	70-100	60-100	40-90	15-25	5-10
	27-60	Sapric material, hemic material.	PT	A-8	0	---	---	---	---	---	---
We---------------- Warners	0-10	Silt loam---------	ML, CL, OL	A-7, A-5	0	95-100	95-100	90-100	70-95	42-50	5-15
	10-20	Silt loam, loam, silty clay loam.	ML, CL	A-4	0	95-100	95-100	90-100	70-95	15-30	5-10
	20-60	Marl--------------	---	---	0	---	---	---	---	---	---
Wh---------------- Washtenaw	0-5	Silt loam---------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	27-36	4-12
	5-55	Silt loam, loam	CL, ML	A-6, A-4	0	100	100	90-100	70-90	27-36	4-12
	55-60	Silty clay loam, clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	75-95	36-50	15-28

* NP means nonplastic.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
Ad------------- Adrian	0-32	---	0.30-0.55	0.2-6.0	0.35-0.45	4.5-5.5	-------------	----	---	3	55-75
	32-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low----------	----			
BaA------------- Blount	0-9	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low----------	0.43	3	6	2-3
	9-42	35-50	1.40-1.70	0.06-0.6	0.12-0.19	4.5-7.3	Moderate-----	0.43			
	42-60	30-35	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	Moderate-----	0.43			
Br-------------- Bourbon	0-9	10-20	1.40-1.55	2.0-6.0	0.10-0.15	5.1-7.3	Low----------	0.20	5	3	3-5
	9-16	10-18	1.40-1.55	2.0-6.0	0.10-0.17	4.5-6.5	Low----------	0.24			
	16-41	10-18	1.40-1.55	2.0-6.0	0.07-0.16	4.5-5.8	Low----------	0.24			
	41-60	3-10	1.60-1.80	>20	0.03-0.06	5.6-7.3	Low----------	0.15			
BtA------------- Brems	0-9	2-6	1.50-1.65	6.0-20	0.07-0.09	5.1-6.5	Low----------	0.17	5	1	.5-1
	9-60	2-6	1.60-1.75	6.0-20	0.05-0.08	4.5-6.0	Low----------	0.17			
Cd-------------- Cheektowaga	0-13	5-15	1.20-1.50	6.0-20	0.08-0.15	5.6-7.8	Very low-----	0.28	3	---	3-9
	13-30	1-9	1.20-1.50	6.0-20	0.05-0.07	5.6-8.4	Very low-----	0.17			
	30-60	28-60	1.10-1.40	<0.2	0.12-0.17	6.6-8.4	Moderate-----	0.28			
ChB, ChC, ChD---- Chelsea	0-7	8-15	1.50-1.55	6.0-20	0.10-0.15	5.1-7.3	Low----------	0.17	5	2	.5-1
	7-80	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-5.5	Low----------	0.17			
Ck-------------- Cohoctah	0-18	5-20	1.12-1.59	2.0-6.0	0.13-0.22	5.1-6.1	Low----------	0.28	5	3	1-4
	18-60	2-25	1.46-1.95	2.0-6.0	0.08-0.20	7.4-8.4	Low----------	0.28			
CoA, CoB--------- Coupee	0-16	15-25	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	4	5	1-4
	16-37	18-30	1.40-1.60	0.6-2.0	0.17-0.20	5.1-6.0	Low----------	0.32			
	37-45	3-10	1.50-1.65	6.0-20	0.06-0.08	4.5-5.5	Low----------	0.17			
	45-60	2-6	1.50-1.65	>20	0.04-0.06	4.5-5.5	Low----------	0.10			
Du*. Duneland											
Ed-------------- Edwards	0-22	---	0.30-0.55	0.2-6.0	0.35-0.45	3.5-6.0	-------------	----	---	3	55-75
	22-60	---	---	---	---	7.4-8.4	-------------	----			
EsA, EsB--------- Elston	0-19	10-20	1.30-1.45	2.0-6.0	0.17-0.22	5.1-7.3	Low----------	0.28	4	5	2-6
	19-26	10-23	1.35-1.60	2.0-6.0	0.12-0.18	4.5-6.0	Low----------	0.20			
	26-48	4-10	1.45-1.65	2.0-6.0	0.08-0.13	5.6-6.0	Low----------	0.20			
	48-60	1-5	1.60-1.75	>20	0.05-0.07	5.6-8.4	Low----------	0.15			
Fh*. Fluvaquents											
Gf-------------- Gilford	0-10	10-20	1.50-1.70	2.0-6.0	0.16-0.18	5.6-7.3	Low----------	0.20	4	3	2-4
	10-36	8-17	1.60-1.80	2.0-6.0	0.12-0.14	5.6-7.3	Low----------	0.20			
	36-60	3-12	1.70-1.90	6.0-20	0.05-0.08	6.6-8.4	Low----------	0.15			
HaA------------- Hanna	0-13	12-20	1.35-1.55	0.6-2.0	0.13-0.15	5.1-7.3	Low----------	0.24	5	3	1-3
	13-31	22-30	1.40-1.60	0.6-2.0	0.12-0.19	4.5-5.5	Low----------	0.24			
	31-65	3-12	1.50-1.70	6.0-20	0.12-0.14	5.1-5.5	Low----------	0.24			
	65-80	2-8	1.60-1.75	6.0-20	0.05-0.07	5.6-6.0	Low----------	0.24			
Hh*: Histosols.											
Aquolls.											

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
Hk-------------- Homer	0-10	10-17	1.35-1.55	0.6-2.0	0.20-0.24	6.1-7.3	Low-----------	0.37	4	5	1-3
	10-22	27-35	1.45-1.65	0.6-2.0	0.17-0.19	6.1-7.8	Moderate------	0.37			
	22-34	17-27	1.45-1.65	0.6-2.0	0.15-0.17	7.4-8.4	Low-----------	0.37			
	34-60	2-8	1.50-1.70	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
Hm, Ho----------- Houghton	0-70	---	0.15-0.45	0.2-6.0	0.35-0.45	5.1-7.8	--------------	----	---	3	>70
Md--------------- Martisco	0-9	---	---	0.6-6.0	0.25-0.35	6.1-8.4	Low-----------	----	---	---	>25
	9-60	---	---	0.06-0.2	---	7.9-8.4	Low-----------	----			
Mm--------------- Maumee	0-18	2-10	1.60-1.75	6.0-20	0.10-0.12	6.1-7.3	Low-----------	0.17	5	2	2-4
	18-60	2-10	1.60-1.75	6.0-20	0.05-0.07	6.1-8.4	Low-----------	0.17			
Mn--------------- Maumee Variant	0-12	2-12	1.35-1.50	6.0-20	0.07-0.12	6.6-8.4	Low-----------	0.17	5	2	4-10
	12-35	2-6	1.4-1.60	>20	0.06-0.08	6.6-8.4	Low-----------	0.17			
	35-45	---	---	2.0-6.0	0.35-0.45	6.6-8.4	--------------	----			
	45-60	2-6	1.40-1.60	>20	0.05-0.07	7.9-8.4	Low-----------	0.15			
Mp--------------- Milford	0-17	35-42	1.35-1.55	0.6-2.0	0.12-0.23	5.6-7.3	High----------	0.28	5	4	5-6
	17-38	35-42	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.5	Moderate------	0.43			
	38-60	20-30	1.50-1.70	0.2-0.6	0.20-0.22	7.4-8.4	Moderate------	0.43			
MrB2, MrC2, MrD2- Morley	0-8	22-27	1.35-1.60	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.43	3	6	2-3
	8-34	35-45	1.50-1.70	0.2-0.6	0.18-0.20	5.1-8.4	Moderate------	0.43			
	34-60	27-40	1.60-1.90	0.2-0.6	0.07-0.12	6.6-8.4	Moderate------	0.43			
Mx--------------- Morocco	0-6	1-6	1.40-1.60	6.0-20	0.10-0.12	4.5-6.5	Low-----------	0.17	5	2	1-4
	6-60	1-6	1.50-1.70	6.0-20	0.05-0.07	4.5-6.0	Low-----------	0.17			
Mz--------------- Muskego	0-16	2-4	0.10-0.21	0.2-6.0	0.35-0.45	5.6-7.3	--------------	----	---	3	50-77
	16-60	---	0.10-0.40	0.06-0.2	0.18-0.24	6.6-8.4	--------------	----			
Nf--------------- Newton	0-15	3-7	1.45-1.60	6.0-20	0.10-0.12	5.1-6.0	Low-----------	0.17	5	2	2-4
	15-60	2-7	1.60-1.75	6.0-20	0.05-0.07	4.5-5.5	Low-----------	0.17			
OaC, OaE--------- Oakville	0-4	0-10	1.27-1.56	>20	0.07-0.09	5.6-7.3	Low-----------	0.15	5	1	1-4
	4-60	0-10	1.26-1.67	>20	0.06-0.08	5.6-7.3	Low-----------	0.15			
Pa--------------- Palms	0-24	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-8.4	--------------	----	---	3	>75
	24-60	7-35	1.46-2.00	0.2-2.0	0.14-0.22	6.1-8.4	Low-----------	----			
Pe--------------- Pewamo	0-10	27-40	0.91-1.55	0.6-2.0	0.17-0.22	6.1-7.3	Moderate------	0.24	5	6	2-5
	10-39	35-50	1.39-1.78	0.2-0.6	0.12-0.20	6.1-7.8	Moderate------	0.24			
	39-60	30-40	1.51-1.80	0.2-0.6	0.14-0.18	7.4-8.4	Moderate------	0.24			
Ph--------------- Pinhook	0-12	10-20	1.35-1.50	2.0-6.0	0.20-0.22	4.5-7.3	Low-----------	0.32	4	5	2-4
	12-39	8-17	1.60-1.80	2.0-6.0	0.12-0.19	4.5-5.5	Low-----------	0.32			
	39-60	3-12	1.70-1.90	>6.0	0.05-0.07	5.1-7.3	Low-----------	0.10			
Qu--------------- Quinn	0-8	8-15	1.30-1.50	0.6-2.0	0.20-0.24	4.5-7.3	Low-----------	0.32	4	5	2-4
	8-27	5-15	1.35-1.60	0.6-2.0	0.14-0.20	4.5-6.0	Low-----------	0.32			
	27-60	2-8	1.50-1.70	6.0-20	0.05-0.10	4.5-6.0	Low-----------	0.32			
RlA, RlB2, RlC2, RlD2, RlF------- Riddles	0-14	8-16	1.30-1.50	0.6-2.0	0.20-0.24	6.1-7.3	Low-----------	0.32	5	5	.5-2
	14-47	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate------	0.32			
	47-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low-----------	0.32			
Sa*:											
Saugatuck--------	0-10	2-12	0.60-1.60	6.0-20	0.10-0.12	4.5-5.5	Low-----------	0.15	3	2	2-7
	10-30	2-12	1.75-2.00	0.06-0.2	0.02-0.04	4.5-5.5	Low-----------	0.15			
	30-60	2-12	1.50-1.65	6.0-20	0.05-0.07	5.1-6.5	Low-----------	0.15			
Pipestone--------	0-9	2-12	0.63-1.57	6.0-20	0.07-0.10	4.5-7.3	Low-----------	0.17	5	2	3-4
	9-32	2-12	1.22-1.57	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.17			
	32-60	2-12	1.22-1.57	>20	0.05-0.07	5.1-7.3	Low-----------	0.17			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
Sb----------------	0-9	10-25	1.15-1.60	0.6-2.0	0.18-0.22	6.1-7.8	Low-----------	0.24	4	5	1-4
Sebewa	9-36	18-35	1.50-1.80	0.6-2.0	0.15-0.19	6.1-7.8	Low-----------	0.24			
	36-60	0-3	1.55-1.75	6.0-20	0.02-0.04	7.4-8.4	Low-----------	0.10			
SeA, SeB----------	0-22	2-15	1.25-1.41	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.15	5	2	1-4
Selfridge	22-25	8-18	1.35-1.45	6.0-20	0.12-0.14	5.6-7.3	Low-----------	0.15			
	25-60	18-35	1.43-1.90	0.2-2.0	0.14-0.20	7.4-8.4	Moderate------	0.37			
So----------------	0-22	27-32	1.35-1.50	0.6-2.0	0.17-0.20	6.1-7.8	Moderate------	0.32	5	7	4-8
Suman	22-34	20-32	1.40-1.60	0.2-0.6	0.17-0.20	6.1-7.9	Moderate------	0.32			
	34-60	3-10	1.60-1.75	6.0-20	0.04-0.09	6.1-7.8	Low-----------	0.10			
TcA, TcB, TcC2, TcD2, TcF--------	0-8	8-16	1.40-1.55	0.6-2.0	0.13-0.15	4.5-5.5	Low-----------	0.24	5	3	1-4
Tracy	8-25	8-18	1.40-1.60	0.6-2.0	0.12-0.19	4.5-5.0	Low-----------	0.24			
	25-46	3-24	1.45-1.65	0.6-2.0	0.10-0.17	4.5-5.0	Low-----------	0.10			
	46-60	3-8	1.60-1.75	6.0-20	0.05-0.10	5.6-6.0	Low-----------	0.10			
Tr----------------	0-35	20-27	1.15-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.28	5	6	3-5
Troxel	35-47	20-35	1.30-1.50	0.6-2.0	0.15-0.20	5.6-7.3	Moderate------	0.28			
	47-80	20-35	1.35-1.65	0.6-2.0	0.09-0.19	6.6-7.8	Low-----------	0.28			
TyA---------------	0-13	3-8	1.40-1.55	6.0-20	0.10-0.12	5.1-7.3	Low-----------	0.17	5	2	.5-1
Tyner	13-40	3-8	1.45-1.60	6.0-20	0.09-0.11	4.5-6.5	Low-----------	0.17			
	40-60	1-3	1.55-1.70	>20	0.05-0.08	5.1-6.0	Low-----------	0.17			
Ua*. Udorthents											
Uc*: Urban land.											
Coupee------------	0-16	15-25	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.32	4	5	1-4
	16-37	18-30	1.40-1.60	0.6-2.0	0.17-0.20	5.1-6.0	Low-----------	0.32			
	37-45	3-10	1.50-1.65	6.0-20	0.06-0.08	5.1-5.5	Low-----------	0.17			
	45-60	2-6	1.50-1.65	>20	0.04-0.06	5.1-5.5	Low-----------	0.10			
UoC*: Urban land.											
Oakville----------	0-4	0-10	1.27-1.56	>20	0.07-0.09	5.6-7.3	Low-----------	0.15	5	1	1-4
	4-60	0-10	1.26-1.67	>20	0.06-0.08	5.6-7.3	Low-----------	0.15			
Uv*: Urban land.											
Morocco-----------	0-6	1-6	1.40-1.60	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.17	5	2	1-4
	6-60	1-6	1.50-1.70	6.0-20	0.05-0.07	4.5-6.0	Low-----------	0.17			
Wa----------------	0-10	10-27	1.15-1.40	0.6-2.0	0.16-0.21	5.1-7.3	Low-----------	0.49	3	---	4-12
Wallkill	10-27	15-27	1.15-1.45	0.6-2.0	0.15-0.20	5.1-7.3	Low-----------	0.43			
	27-60	---	---	0.2-6.0	0.19-0.22	5.6-7.3	Low-----------	----			
We----------------	0-10	---	---	0.2-2.0	0.17-0.22	6.1-7.8	Low-----------	----	---	---	---
Warners	10-20	---	---	0.2-2.0	0.16-0.20	7.4-7.8	Low-----------	----			
	20-60	---	---	---	---	7.9-8.4	Low-----------	----			
Wh----------------	0-5	15-27	1.30-1.45	0.6-2.0	0.22-0.24	6.1-7.3	Low-----------	0.37	5	5	3-7
Washtenaw	5-55	15-27	1.30-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.37			
	55-60	28-35	1.40-1.60	0.06-0.2	0.15-0.20	6.1-7.3	Moderate------	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--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 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			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ad*: Adrian	A/D	None	---	---	+1-1.0	Apparent	Nov-May	>60	---	High	High	Moderate.
BaA: Blount	C	None	---	---	1.0-3.0	Perched	Jan-May	>60	---	High	High	High.
Br: Bourbon	B	None	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High	Low	Moderate.
BtA: Brems	A	None	---	---	2.0-3.0	Apparent	Jan-Apr	>60	---	Low	Low	High.
Cd*: Cheektowaga	D	None	---	---	+.5-0.5	Perched	Nov-Jun	>60	---	Moderate	High	Moderate.
ChB, ChC, ChD: Chelsea	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Ck: Cohoctah	B/D	Frequent	Brief to long.	Jan-Dec	0-1.0	Apparent	Sep-May	>60	---	High	High	Low.
CoA, CoB: Coupee	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	High.
Du**. Duneland												
Ed*: Edwards	B/D	None	---	---	+1-0.5	Apparent	Sep-Jun	>60	---	High	High	Low.
EsA, EsB: Elston	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
Fh**. Fluvaquents												
Gf*: Gilford	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High	High	Moderate.
HaA: Hanna	B	None	---	---	3.0-6.0	Apparent	Mar-Apr	>60	---	High	Moderate	High.
Hh**: Histosols.												
Aquolls.												
Hk: Homer	B	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	High.

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Hm*, Ho*---------- Houghton	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	High-----	High-----	Low.
Md*--------------- Martisco	D	None---------	---	---	+.5-0.5	Apparent	Oct-Jun	>60	---	High-----	High-----	Low.
Mm*--------------- Maumee	A/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	Moderate	High-----	Moderate.
Mn*--------------- Maumee Variant	A/D	Frequent----	Brief-----	Mar-Apr	+.5-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Moderate.
Mp*--------------- Milford	B/D	None---------	---	---	+.5-2.0	Apparent	Mar-Jun	>60	---	High-----	High-----	Low.
MrB2, MrC2, MrD2-- Morley	C	None---------	---	---	3.0-6.0	Perched	Mar-May	>60	---	Moderate	High-----	Moderate.
Mx---------------- Morocco	B	None---------	---	---	1.0-2.0	Apparent	Jan-Apr	>60	---	Moderate	Low------	High.
Mz*--------------- Muskego	A/D	None---------	---	---	+1-1.0	Apparent	Nov-Aug	>60	---	High-----	Moderate	Moderate.
Nf*--------------- Newton	A/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	Moderate	High-----	High.
OaC, OaE---------- Oakville	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
Pa*--------------- Palms	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
Pe*--------------- Pewamo	C/D	None---------	---	---	+1-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Low.
Ph---------------- Pinhook	B/D	None---------	---	---	0-1.0	Apparent	Jan-May	>60	---	High-----	High-----	High.
Qu---------------- Quinn	B/D	None---------	---	---	0-1.0	Apparent	Jan-May	>60	---	High-----	High-----	High.
RlA, RlB2, RlC2, RlD2, RlF-------- Riddles	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Sa**:												
Saugatuck---------	C	None---------	---	---	+1-2.0	Perched	Dec-Jun	>60	---	Moderate	High-----	High.
Pipestone---------	A	None---------	---	---	0.5-1.5	Apparent	Oct-Jun	>60	---	Moderate	Low------	Moderate.
Sb*--------------- Sebewa	B/D	None---------	---	---	+1-1.0	Apparent	Sep-May	>60	---	High-----	High-----	Low.

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
SeA, SeB----------- Selfridge	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	>60	---	High-----	High-----	Low.
So----------------- Suman	B/D	Frequent----	Very brief	Nov-Jun	0-0.5	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
TcA, TcB, TcC2, TcD2, TcF--------- Tracy	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	High.
Tr----------------- Troxel	B	Occasional	Very brief	Mar-Jun	>6.0	---	---	>60	---	High-----	Low-------	Moderate.
TyA---------------- Tyner	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	High.
Ua**. Udorthents												
Uc**: Urban land.												
Coupee-----------	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Moderate	High.
UoC**: Urban land.												
Oakville----------	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
Uv**: Urban land.												
Morocco-----------	B	None---------	---	---	1.0-2.0	Apparent	Jan-Apr	>60	---	Moderate	Low-------	High.
Wa*---------------- Wallkill	D	None---------	---	---	+.5-0.5	Apparent	Sep-Jun	>60	---	High-----	Moderate	Moderate.
We*---------------- Warners	D	None---------	---	---	+.5-0.5	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
Wh*---------------- Washtenaw	C/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Low.

* In the ""High water table-Depth'' column, a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Aquolls	Loamy, mixed, mesic Haplaquolls
Blount	Fine, illitic, mesic Aeric Ochraqualfs
Bourbon	Coarse-loamy, mixed, mesic Aquultic Hapludalfs
Brems	Mixed, mesic Aquic Udipsamments
Cheektowaga	Sandy over clayey, mixed, mesic Typic Haplaquolls
Chelsea	Mixed, mesic Alfic Udipsamments
*Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Coupee	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Ultic Hapludalfs
*Edwards	Marly, euic, mesic Limnic Medisaprists
*Elston	Coarse-loamy, mixed, mesic Typic Argiudolls
Fluvaquents	Loamy, mixed, nonacid, mesic Fluvaquents
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Hanna	Coarse-loamy, mixed, mesic Aquultic Hapludalfs
Histosols	Euic, mesic Medisaprists
*Homer	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aeric Ochraqualfs
Houghton	Euic, mesic Typic Medisaprists
Martisco	Fine-silty, carbonatic, mesic Histic Humaquepts
Maumee	Sandy, mixed, mesic Typic Haplaquolls
Maumee Variant	Sandy, mixed, mesic Typic Haplaquolls
Milford	Fine, mixed, mesic Typic Haplaquolls
Morley	Fine, illitic, mesic Typic Hapludalfs
Morocco	Mixed, mesic Aquic Udipsamments
Muskego	Coprogenous, euic, mesic Limnic Medisaprists
*Newton	Sandy, mixed, mesic Typic Humaquepts
Oakville	Mixed, mesic Typic Udipsamments
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Pewamo	Fine, mixed, mesic Typic Argiaquolls
Pinhook	Coarse-loamy, mixed, mesic Mollic Ochraqualfs
Pipestone	Sandy, mixed, mesic Entic Haplaquods
Quinn	Coarse-loamy, mixed, mesic Typic Ochraqualfs
Riddles	Fine-loamy, mixed, mesic Typic Hapludalfs
*Saugatuck	Sandy, mixed, mesic, ortstein Aeric Haplaquods
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Selfridge	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Suman	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Fluvaquentic Haplaquolls
Tracy	Coarse-loamy, mixed, mesic Ultic Hapludalfs
*Troxel	Fine-silty, mixed, mesic Typic Argiudolls
Tyner	Mixed, mesic Typic Udipsamments
Udorthents	Loamy, mixed, nonacid mesic Udorthents
*Wallkill	Fine-loamy, mixed, nonacid, mesic Thapto-Histic Fluvaquents
*Warners	Fine-silty, carbonatic, mesic Fluvaquentic Haplaquolls
*Washtenaw	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents

*The soil is a taxadjunct to the series. See text for description of those characteristics of the soil that are outside the range of the series.

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