United States Department of Agriculture

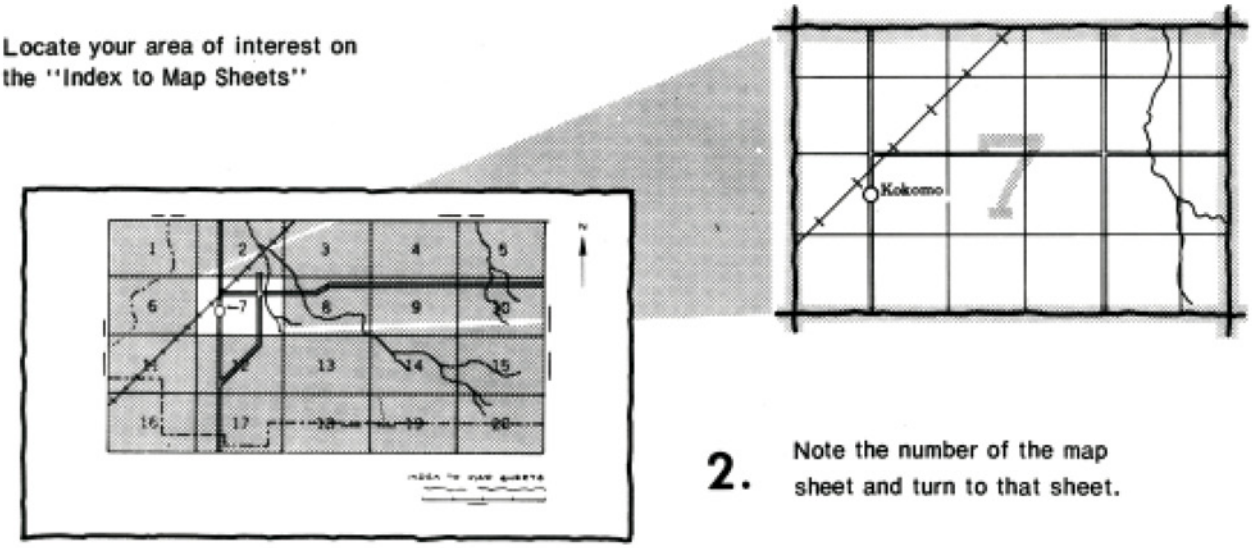
Soil Conservation Service

In cooperation with United States Department of Agriculture, Forest Service, and the Research Division of the College of Agricultural and Life Sciences, University of Wisconsin

Soil Survey of Oconto County, Wisconsin

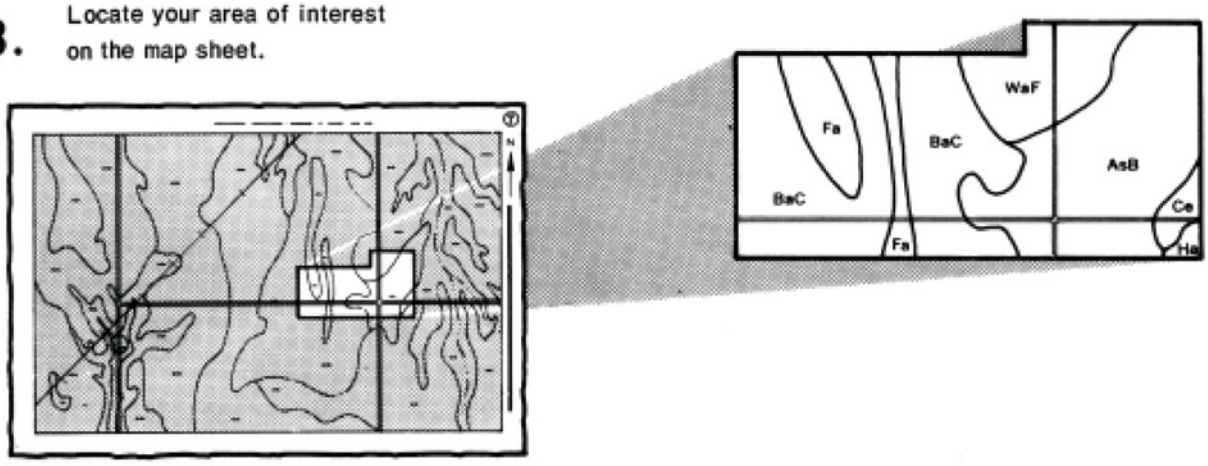
HOW TO USE

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

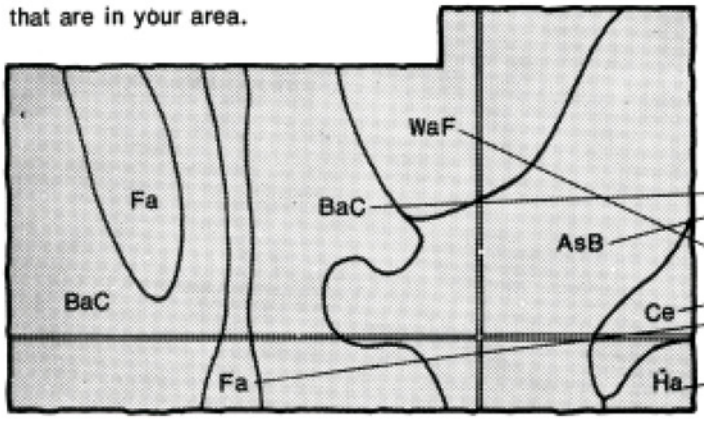


2. Note the number of the map sheet and turn to that sheet.

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



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



Symbols

- AsB
- BaC
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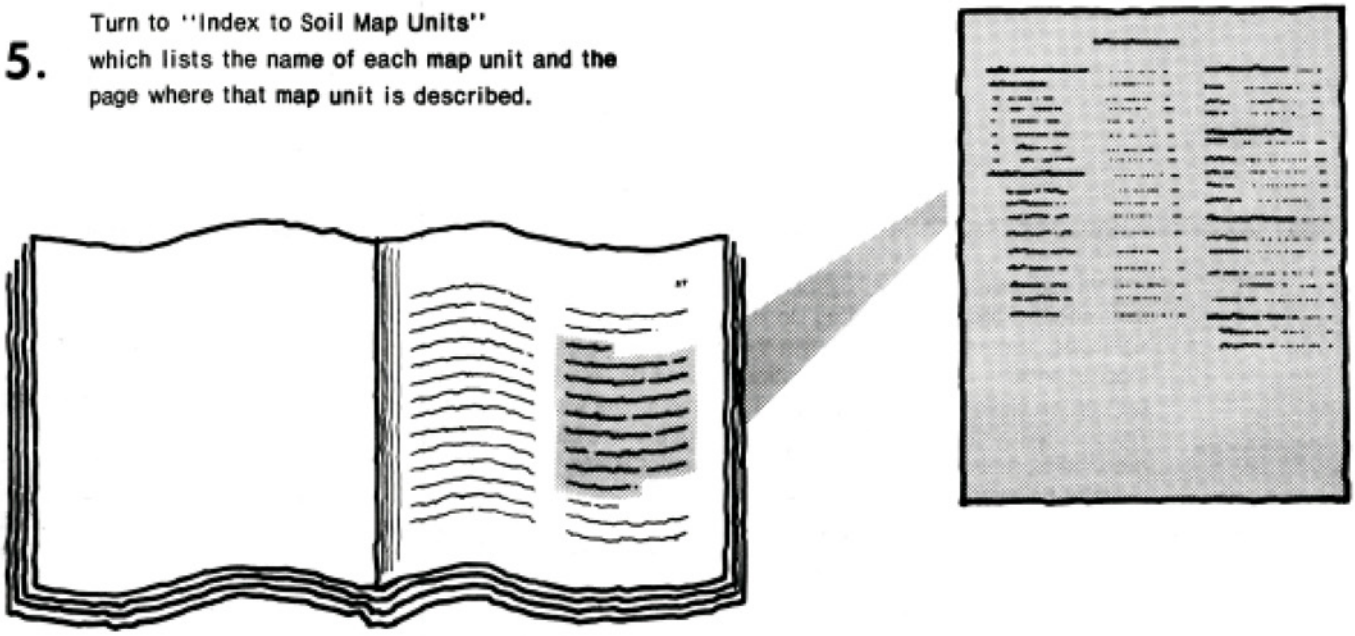
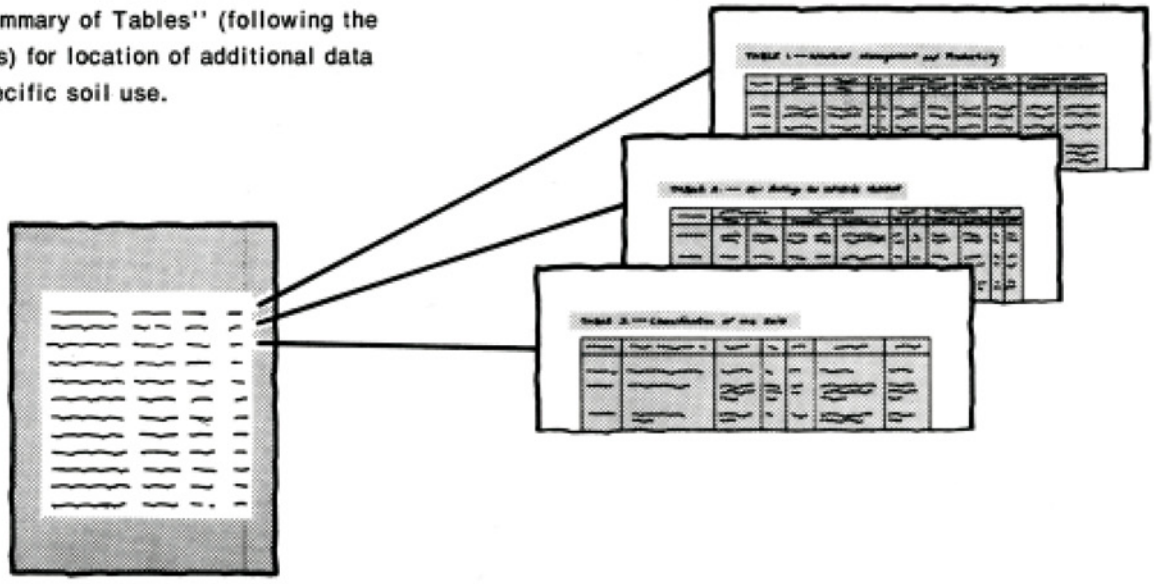
- WaF

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, handicap, or age.

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Research Division of the College of Agricultural and Life Sciences, University of Wisconsin. It is part of the technical assistance furnished to the Oconto County Land Conservation Committee, which helped to finance the fieldwork.

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

Cover: A small pond dug in an area of Seelyeville soils. The pond attracts waterfowl, furbearers, deer, and many kinds of songbirds.

Contents

Soil Series

Issued September 1988

Index to Map Units

Summary of Tables

Foreword

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

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

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are 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.

Cliffton A. Maguire
State Conservationist
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Soil Survey of Oconto County, Wisconsin

By David C. Roberts, John E. Campbell, and Terry L. Kroll,
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Fieldwork by John E. Campbell, Terry L. Kroll, Charles F. Leonard,
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United States Department of Agriculture,
Soil Conservation Service and Forest Service,
in cooperation with
the Research Division of the College of Agricultural and Life Sciences,
University of Wisconsin

OCONTO COUNTY is in the northeastern part of Wisconsin (fig. 1). It has a total area of 650,976 acres, of which 9,600 acres is water. The city of Oconto, the largest community in the county, is the county seat.

This survey updates a reconnaissance soil survey of Oconto County published in 1916 (*11*). It provides additional information and larger, more detailed soil maps.

General Nature of the County

This section gives general information about the county. It describes the history and development; climate; physiography, relief, and drainage; water supply; and transportation facilities and industry.

History and Development

The first known inhabitants of the survey area were the Copper Culture People. Investigation of burial sites near the city of Oconto indicates that these people lived in the region between 5600 and 5500 B.C. (*3*).

The county was named after an early Indian settlement called "Oak-a-toe." The county name has since been changed to Oconto. These Indians were members of the Menominee tribe.

The first white men came to Oconto County and the Green Bay area in the early 1600's. They were either fur traders or missionaries. The Mission of St. Francis Xavier was founded along Green Bay, at the mouth of the Oconto River, in 1669. Exploration and fur trading continued for the next 150 years. In the early 1800's, the rich timber resource of the region attracted the first white settlers.

On November 4, 1851, the first election was held in what is now Oconto. Its purpose was the formation of a new county from the northern portion of what was then Brown County. This new county was named Oconto. In 1854, the first steamboats began to travel the Oconto River. By the spring of 1855, construction had started on the first state road, which connected Green Bay with Menominee, Michigan. Oconto continued to prosper as a lumber town. By the turn of the century, the Holt and Oconto Lumber Companies were producing 60 million board feet of lumber per year.

Agriculture in Oconto County was first practiced by the Menominee Indians. A more permanent type of agriculture developed in conjunction with the lumbering industry. The first farmers raised a few sheep and hogs and grew potatoes and other vegetables that were sold to the lumbering camps. By the 1880's, dairy farming had become predominant.

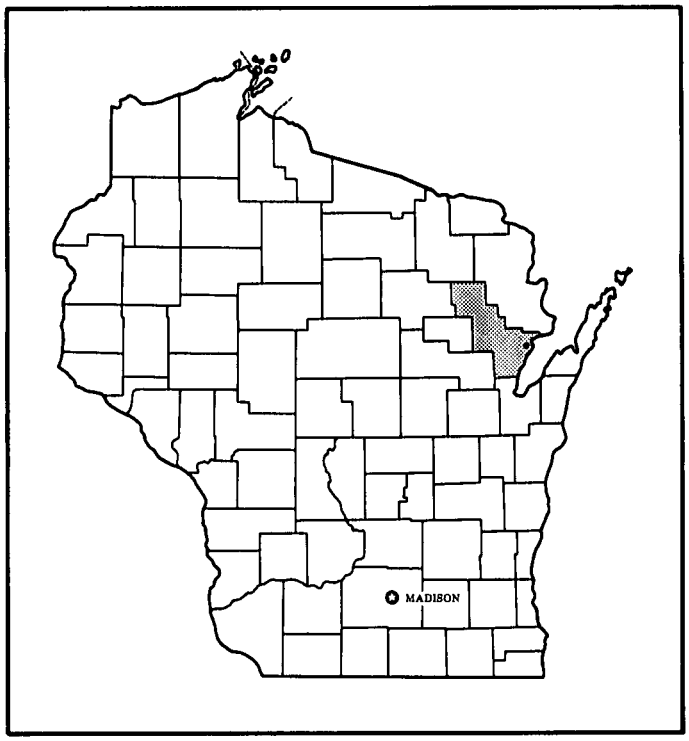

Figure 1.—Location of Oconto County in Wisconsin.

The soil that once yielded millions of board feet of lumber is still the backbone of Oconto County's economy. Agriculture is the main industry. Forestry and recreation are also important.

The population of Oconto County was 28,947 in 1980. This represented an increase of 13.2 percent over 1970.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

In Oconto County winters are very cold. Summers are short and fairly warm. A short growing season limits cropping mainly to forage, small grain, adapted corn varieties, and vegetables. Precipitation is fairly well distributed throughout the year, reaching a slight peak in summer. Snow covers the ground much of the time from late in fall through early in spring.

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

In winter the average temperature is 19 degrees F, and the average daily minimum temperature is 9 degrees. The lowest temperature on record, which occurred at Oconto on January 15, 1972, is -30 degrees. In summer the average temperature is 67 degrees, and the average daily maximum temperature is 79 degrees. The highest recorded temperature, which occurred at Oconto on August 21, 1955, is 102 degrees.

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

The total annual precipitation is 29.72 inches. Of this, about 19 inches, or 65 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 15 inches. The heaviest 1-day rainfall during the period of record was 5.5 inches at Oconto on August 1, 1964. Thunderstorms occur on about 35 days each year.

The average seasonal snowfall is about 45 inches. The greatest snow depth at any one time during the period of record was 36 inches. On the average, 41 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

Soils occasionally freeze to a depth of several feet when very cold weather occurs before the ground is

appreciably covered with snow. Usually, the soil is frozen in only the top few inches or to a depth of 1 foot, except where the snow cover has been removed.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Physiography, Relief, and Drainage

The nature of the glacial features, along with the type of bedrock, divides Oconto County into three different regions.

The northern region, including Armstrong, Doty, Lakewood, Riverview, and Townsend Townships, was once a mountainous area of folded and faulted Precambrian crystalline rock. This area was smoothed by a long period of erosion. Additional smoothing occurred during the Pleistocene glaciation. The remaining granitic rocks are in some road cuts or occur as ridgetop outcrops near the town of Mountain and near Crooked Lake. Some of the highest elevations in Wisconsin are in this part of the county. Thunder Mountain, 1,375 feet above sea level, is near the Oconto-Marinette county line. McCaslin Mountain, 1,625 feet above sea level, is at the junction of Forest, Marinette, and Oconto Counties. The major landforms in this region are end moraines and pitted outwash plains.

The central region is a hilly and undulating end moraine east of the Oconto River and Peshtigo Brook. Parts of Brazeau, Gillett, Maple Valley, Spruce, and Underhill Townships are included in this area. The end moraine is interspersed with ground moraines and outwash plains, which merge with the ridge and lowland region in the southeastern part of the county.

The southeastern region is a broad, undulating ground moraine, which slopes to the east. It is overlain by glacial lake deposits along Green Bay. A series of low ridges generally oriented northeast to southwest characterizes the northeastern part of this region. The entire ground moraine encloses numerous depressions and basins and is interspersed with lake plains and outwash plains.

Most of Oconto County is drained by the Oconto River, which flows southeast and east to Green Bay. Small areas in the northeastern and eastern parts of the county are within the basin of the Peshtigo River. Part of the Pensaukee and Little Suamico watersheds are south of the city of Oconto.

Water Supply

Robert N. Cheetham, Jr., geologist, Soil Conservation Service, helped prepare this section.

Oconto County has many streams, lakes, and rivers, which furnish a good supply of surface water. Ground water resources supply most of the water for both municipal and private uses. Surface water is used for stock watering and for recreational purposes.

The depth to ground water depends on the general topography, the elevation above the permanent stream level, and the lithology of the underlying bedrock and glacial deposits. Water is stored in porous and permeable strata, or aquifers. The level of ground water rises and falls from season to season and year to year, depending on the annual amount of precipitation.

Glacial drift aquifers are the major source of ground water in most of the county. The glacial drift throughout most of the county is 0 to 300 feet thick. Wells drilled into this drift yield 10 to more than 500 gallons of water per minute (*7*).

The northwestern part of the county is underlain by crystalline rock of Precambrian age. The availability of water from the bedrock is difficult to predict, but yields are probably less than 5 gallons of water per minute. The glacial drift aquifer above the bedrock is the best source of ground water.

The southeastern part of the county yields ground water from sedimentary bedrock aquifers of Upper Cambrian to Ordovician age. Cambrian sandstone, Prairie du Chien dolomite, and St. Peter sandstone are the bedrock aquifers in this area. In general, these bedrock aquifers are hydraulically connected and act as a single aquifer. Wells in this area yield 10 to more than 500 gallons of water per minute. The Galena-Platteville bedrock formation in the Sinnipee Group is a separate aquifer. It yields a maximum of 60 gallons of water per minute. It has no known high-capacity wells.

The ground water in Oconto County generally is of very good quality. It is suitable for most domestic, municipal, and industrial uses, but treatment may be required for special purposes. Local differences in the quality of ground water result from the composition, solubility, and surface area of soil and rock particles through which the water moves and the length of time that the water is in contact with these materials. The main chemical elements of the moderately hard and hard water are calcium, magnesium, and bicarbonate ions derived from dolomite and glacial drift. Ground water from the glacial drift and sedimentary rocks of Upper Cambrian and Ordovician age generally has less than 300 milligrams per liter of dissolved solids. Data for the crystalline bedrock are insufficient to measure water hardness. Minor water use problems are caused by hardness and, in some areas, by high concentrations of iron.

Transportation Facilities and Industry

Two railroads provide service in Oconto County. A well maintained system of paved and gravel roads provides easy access to most parts of the county, except for the Nicolet National Forest, where access to many areas is

limited. U.S. Highways 41 and 141 and State Highway 32 are the principal north-south roads. State Highways 22 and 64 are the principal east-west roads. Commercial air transportation is available in nearby Green Bay, Wisconsin, and Menominee, Michigan.

The major industry in Oconto County is agriculture. Dairy farming is the principal agricultural enterprise. Truck farming is of local importance. A number of agricultural firms are headquartered in the county. The number of farms has decreased in recent years, but production has increased along with the value of land and buildings and the size of farms.

About 55 percent of Oconto County is woodland, which supports an extensive lumber and wood-products industry. This industry manufactures paper products, plywood and veneer, furniture, and lumber for building. The production of maple syrup is a seasonal enterprise of local importance.

Excavation for minerals is of minor extent. The minerals include sand and gravel and crushed or ground dolomite (fig. 2).

Recreation and tourism are important industries, especially near Green Bay and in the Nicolet National Forest. Green Bay, along with numerous streams and lakes, provides opportunities for swimming, fishing, and boating. It also attracts many vacationers and sportsmen. Wildlife, especially white-tailed deer, attract hunters from throughout the state and from northern Illinois. Enough snow for snowmobiling and skiing usually is available in winter.

How This Survey Was Made

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

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

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

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

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

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

Figure 2.—Fractured dolomite exposed in a quarry.

always be at a specific level in the soil on a specific date.

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

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural

objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

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

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

General Soil Map Units

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

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

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

The associations in Oconto County join with similar associations that may have different names in Brown, Langlade, Marinette, and Shawano Counties. Some differences result from variations in the extent or pattern of the soils in the counties. Others result from variations in the scale of the maps. The soils in these associations have similar potentials for land uses. The differences do not significantly affect the use of the maps for general planning.

Soil Descriptions

1. Kennan-Keweenaw-Padus Association

Nearly level to very steep, well drained, loamy and sandy soils on uplands

This association is on flats, convex side slopes, and ridgetops on moraines and outwash plains. It makes up about 7 percent of the county. It is about 34 percent Kennan soils, 18 percent Keweenaw soils, 13 percent Padus soils, and 35 percent soils of minor extent (fig. 3).

Kennan soils are gently sloping to steep. They are moderately permeable in the upper part and moderately permeable or moderately rapidly permeable in the lower part. The available water capacity is moderate. Typically, the surface layer is black fine sandy loam about 3 inches thick. The subsurface layer is brown fine sandy loam about 2 inches thick. The upper subsoil is dark brown, friable fine sandy loam about 9 inches thick. The next 21 inches is mixed brown, friable fine sandy loam and dark brown, friable sandy loam. The lower subsoil is reddish brown, friable sandy loam about 13 inches thick. The substratum to a depth of about 60 inches is reddish brown, friable sandy loam.

Keweenaw soils are gently sloping to very steep. They are moderately permeable or moderately rapidly permeable. The available water capacity is low. Typically, the surface layer is dark brown loamy fine sand about 3 inches thick. The subsoil is about 47 inches thick. The upper part is dark reddish brown and reddish brown, very friable loamy fine sand. The lower part is mixed reddish brown, friable sandy loam and brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is brown, very friable loamy sand.

Padus soils are nearly level to very steep. They are moderately permeable in the upper part and rapidly permeable or very rapidly permeable in the lower part. The available water capacity is moderate. Typically, the surface layer is very dark grayish brown fine sandy loam about 3 inches thick. The upper subsoil is brown, friable sandy loam about 8 inches thick. The next 6 inches is mixed brown, friable fine sandy loam and reddish brown, friable loam. The lower subsoil is about 14 inches of reddish brown, friable loam and dark reddish brown, very friable gravelly loamy sand. The upper part of the substratum is strong brown, loose sand. The lower part to a depth of about 60 inches is dark brown gravelly coarse sand.

Some of the minor soils in this association are the Loxley, Menahga, Minocqua, Seelyeville, and Worcester soils. The very poorly drained Loxley and Seelyeville soils formed in organic material in drainageways, in depressions, and on low lying flats. The excessively drained Menahga soils formed in sandy deposits on flats and convex side slopes. The poorly drained and very poorly drained Minocqua and somewhat poorly drained Worcester soils formed in loamy deposits underlain by outwash sand or sand and gravel. They are on low lying flats and in drainageways and depressions.

Most areas are used as woodland. Some are used for crops. The growth of competing vegetation following harvest and water erosion on the steeper slopes are the main management concerns if the major soils are used for woodland.

Where protected from soil blowing, the nearly level to sloping major soils are suited to crops. The moderately steep to very steep soils are generally unsuited to this

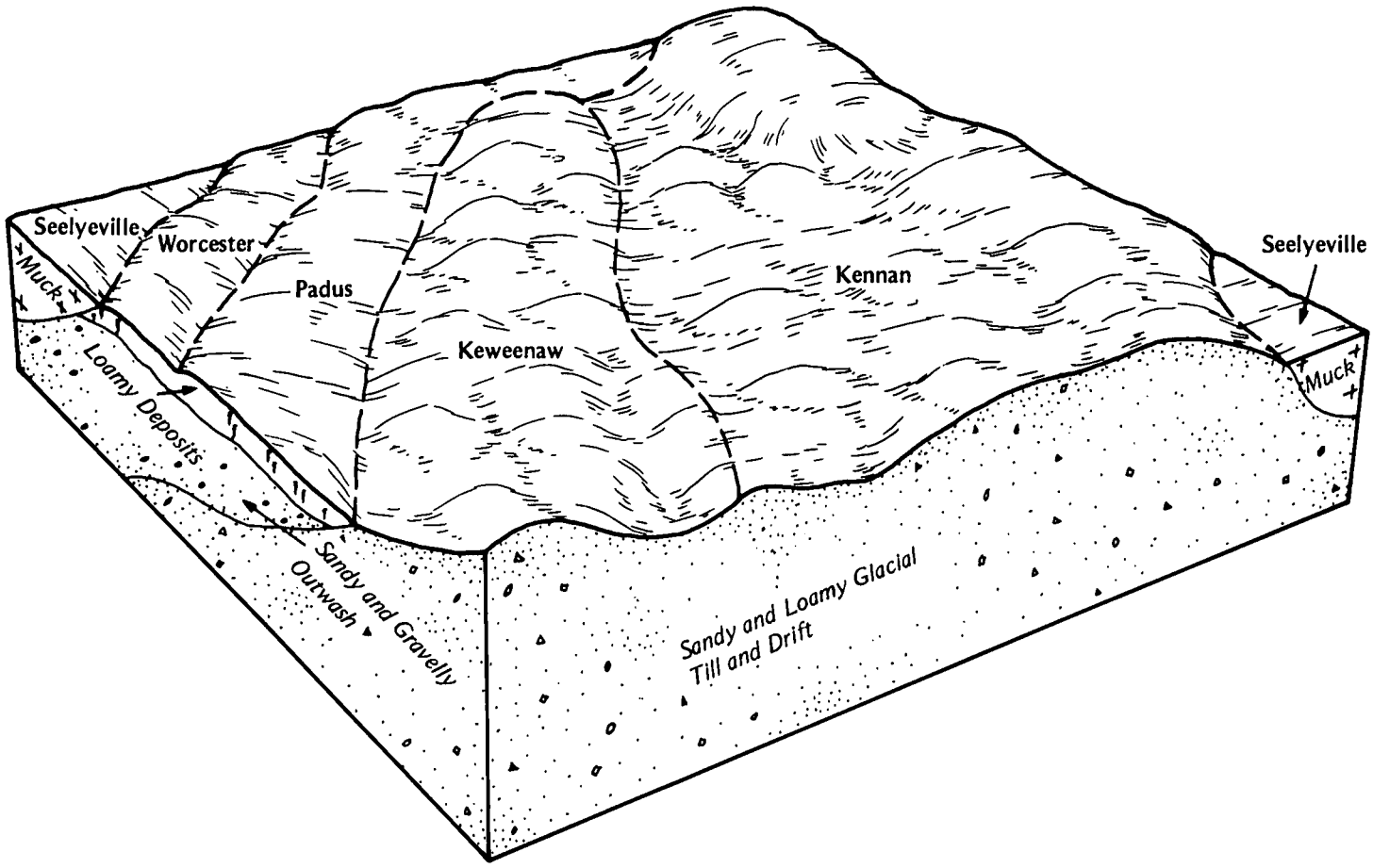

Figure 3.—Typical pattern of soils and parent material in the Kennan-Keweenaw-Padus association.

use. The major soils that have a slope of less than 20 percent are suited to residential development.

2. Padus-Pence Association

Nearly level to very steep, well drained, loamy soils on uplands

This association is on flats, side slopes, and ridgetops on outwash plains and eskers. It makes up about 18 percent of the county. It is about 35 percent Padus soils, 30 percent Pence soils, and 35 percent soils of minor extent.

Padus soils are moderately permeable in the upper part and rapidly permeable or very rapidly permeable in the lower part. The available water capacity is moderate. Typically, the surface layer is very dark grayish brown fine sandy loam about 3 inches thick. The upper subsoil is brown, friable sandy loam about 8 inches thick. The next 6 inches is mixed brown, friable fine sandy loam and reddish brown, friable loam. The lower subsoil is about 14 inches of reddish brown, friable loam and dark reddish brown, very friable gravelly loamy sand. The upper part of the substratum is strong brown, loose sand. The lower part to a depth of about 60 inches is dark brown gravelly coarse sand.

Pence soils are moderately rapidly permeable in the upper part and rapidly permeable or very rapidly permeable in the lower part. The available water capacity is low. Typically, the surface layer is black sandy loam about 1 inch thick. The subsurface layer is dark brown sandy loam about 1 inch thick. The subsoil is about 21 inches thick. It is dark brown, friable sandy loam in the upper part; brown, friable sandy loam in the next part; and brown, very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is strong brown, loose, stratified sand and gravel.

Some of the minor soils in this association are the Kennan, Loxley, Menahga, Minocqua, Seelyeville, and Worcester soils. The well drained Kennan soils formed in loamy deposits and in the underlying loamy or sandy glacial till. They are on ridgetops and side slopes. The very poorly drained Loxley and Seelyeville soils formed

in organic material in depressions. The excessively drained Menahga soils are sandy throughout. They are on flats and convex side slopes. The poorly drained and very poorly drained Minocqua and somewhat poorly drained Worcester soils formed in loamy deposits underlain by outwash sand or sand and gravel. They are on low lying flats and in drainageways and depressions.

Most areas are used as woodland. Some are used for crops. The major soils are suited to trees. The growth of competing vegetation following harvest and water erosion on the steeper slopes are the main concerns in managing woodland.

Where protected from soil blowing and water erosion, the nearly level to sloping major soils are suited to crops. The moderately steep to very steep soils are generally unsuited to this use. The major soils that have a slope of less than 20 percent are suited to residential development. Septic tank absorption fields function satisfactorily, but ground water pollution is a hazard because of the rapid and very rapid permeability in the substratum.

3. Menahga-Rousseau-Shawano Association

Nearly level to very steep, excessively drained and moderately well drained, sandy soils on uplands

This association is on convex side slopes, concave foot slopes, and flats on outwash plains and glacial lake plains. It makes up about 20 percent of the county. It is about 27 percent Menahga soils, 24 percent Rousseau soils, 15 percent Shawano soils, and 34 percent soils of minor extent.

Menahga soils are nearly level to very steep and are excessively drained. They are rapidly permeable. The available water capacity is low. Typically, the surface layer is black sand about 3 inches thick. The subsurface layer is very dark grayish brown sand about 2 inches thick. The subsoil is strong brown and dark yellowish brown, very friable and loose sand about 29 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Rousseau soils are nearly level and gently sloping and are moderately well drained. They are rapidly permeable. The available water capacity is low. Typically, the surface layer is very dark grayish brown fine sand about 8 inches thick. The subsoil is fine sand about 24 inches thick. It is reddish brown and very friable in the upper part and strong brown, mottled, and loose in the lower part. The substratum to a depth of about 60 inches is brown and strong brown, mottled, loose fine sand.

Shawano soils are gently sloping to steep and are excessively drained. They are rapidly permeable. The available water capacity is low. Typically, the surface layer is very dark brown fine sand about 4 inches thick. The subsoil is brown and strong brown, very friable fine sand about 25 inches thick. The substratum to a depth of about 60 inches is strong brown, loose fine sand.

Some of the minor soils in this association are the Cormant, Iosco, Menominee, Seelyeville, and Wainola soils. The poorly drained and very poorly drained Cormant and somewhat poorly drained Wainola soils are in drainageways and depressions and on low lying flats. The somewhat poorly drained Iosco and well drained Menominee soils are underlain by loamy deposits at a depth of 20 to 40 inches. Iosco soils are on concave foot slopes, in drainageways and depressions, and on low lying flats. Menominee soils are on convex side slopes. The very poorly drained Seelyeville soils formed in organic material on low lying flats and in drainageways and depressions.

Most areas are used as woodland. Many have been planted to pine. Some are used for crops. The major soils are suited to trees. Seedling survival and water erosion are the main management concerns if the major soils are used for woodland.

Where irrigated and protected from soil blowing, the nearly level to sloping major soils are suited to crops. The moderately steep to very steep Menahga and Shawano soils are generally unsuited to this use. The Menahga and Shawano soils that have a slope of less than 20 percent are suited to residential development. Septic tank absorption fields function satisfactorily in these soils, but ground water pollution is a hazard because of the rapid permeability. The Rousseau soils are poorly suited to residential development because of the seasonal high water table.

4. Seelyeville-Markey Association

Nearly level, very poorly drained, mucky soils in depressions and drainageways on ground moraines and outwash plains

This association makes up about 7 percent of the county. It is about 40 percent Seelyeville soils, 30 percent Markey soils, and 30 percent soils of minor extent.

Seelyeville soils are moderately rapidly permeable. The available water capacity is very high. Typically, the soils are muck to a depth of more than 60 inches. The muck is very dark gray in the upper part and black and very dark brown in the lower part.

Markey soils are moderately rapidly permeable. The available water capacity is very high. Typically, the soils are black and very dark brown muck to a depth of about 37 inches. The substratum to a depth of about 60 inches is dark grayish brown, loose sand.

Some of the minor soils in this association are the Cormant, Menahga, Rousseau, Shawano, and Wainola soils. All of these soils formed in sandy deposits. The poorly drained and very poorly drained Cormant and somewhat poorly drained Wainola soils are on low lying flats and in depressions and drainageways. The excessively drained Menahga and Shawano soils are on flats and convex side slopes. The moderately well

drained Rousseau soils are on low lying flats and convex side slopes.

Most areas are undrained and support woodland or wetland vegetation. A few are drained and are used for crops. Where adequately drained and protected from ponding and soil blowing, the major soils are suited to crops. Ponding and soil blowing are the main hazards. Wetness is the main limitation. The length of the growing season, which is restricted by frost in spring and early in fall, is a severe limitation affecting most crops. The soils are suited to trees and are generally unsuited to residential development and septic tank absorption fields.

5. Tilleda-Menominee Association

Nearly level to moderately steep, well drained, loamy and sandy soils on uplands

This association is on flats and convex side slopes on moraines. It makes up about 4 percent of the county. It is about 37 percent Tilleda soils, 30 percent Menominee soils, and 33 percent soils of minor extent (fig. 4).

Tilleda soils are nearly level to moderately steep. They are moderately permeable. The available water capacity is high. Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is brown fine sandy loam about 4 inches thick. The next 10 inches is mixed brown, friable fine sandy loam and reddish brown, friable loam. The subsoil is reddish brown, friable loam about 16 inches thick. The substratum to a depth of about 60 inches also is reddish brown, friable loam.

Menominee soils are gently sloping to moderately steep. They are rapidly permeable in the upper part and moderately permeable in the lower part. The available water capacity is moderate. Typically, the surface layer is dark brown loamy fine sand about 9 inches thick. The upper subsoil is strong brown, very friable fine sand about 8 inches thick. The next layer is brown, very friable loamy fine sand about 6 inches thick. The lower subsoil is dark reddish brown, firm clay loam about 6 inches

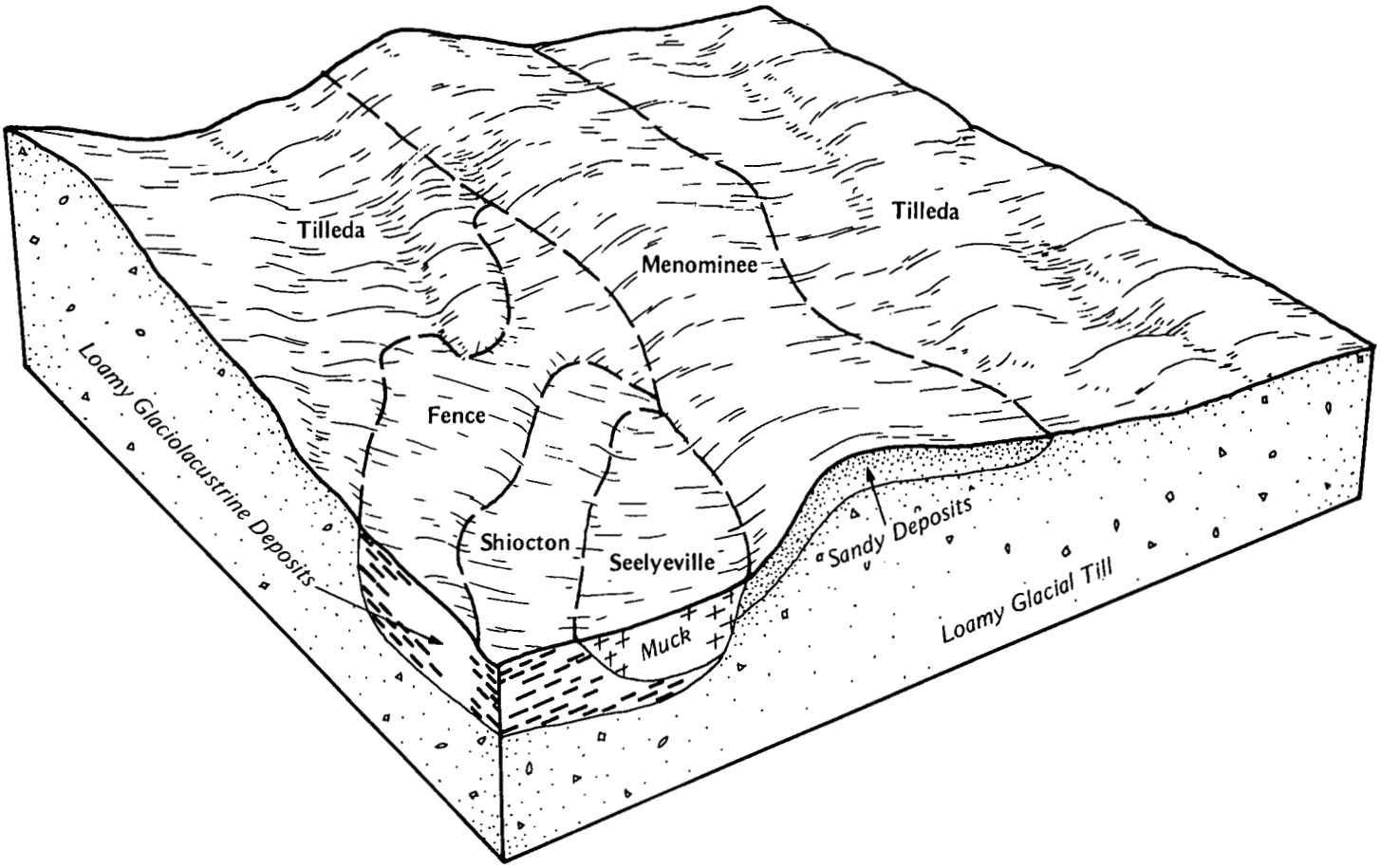

Figure 4.—Typical pattern of soils and parent material in the Tilleda-Menominee association.

thick. The substratum to a depth of about 60 inches is brown, friable sandy loam.

Some of the minor soils in this association are the Fence, Iosco, Seelyeville, Shiocton, and Solona soils. The well drained Fence soils formed in loamy lacustrine deposits on convex side slopes and knolls. The somewhat poorly drained Iosco and Solona soils are on low lying flats, in depressions and drainageways, and on concave foot slopes. The very poorly drained Seelyeville soils formed in organic material on low lying flats and in drainageways and depressions. The somewhat poorly drained Shiocton soils formed in loamy lacustrine deposits on low lying flats, in drainageways and depressions, and on concave foot slopes.

Many of the less sloping areas of the major soils are used for crops. Some areas, especially the steeper ones, are used as woodland or pasture. In most areas the major soils are suited to crops. The moderately steep Menominee soils, however, are generally unsuited. Water erosion and soil blowing are the main hazards if the major soils are used for crops. Also, drought is a hazard in areas of the Menominee soils.

The major soils are suited to trees. The less sloping soils are suited to residential development, but the moderately steep soils are poorly suited because of the slope. The Tilleda soils are moderately limited as sites for septic tank absorption fields because of the moderate permeability, and the Menominee soils are severely limited because of the rapid permeability in the sandy upper layers. Septic tank absorption fields function satisfactorily in the Menominee soils, but the lateral movement of effluent is a hazard if the absorption field is installed in the sandy material.

6. Onaway-Seelyeville-Menominee Association

Nearly level to very steep, well drained, moderately well drained, and very poorly drained, loamy, mucky, and sandy soils on uplands and in depressions

This association is on convex side slopes and in depressions on ground moraines and end moraines. It makes up about 7 percent of the county. It is about 37 percent Onaway soils, 18 percent Seelyeville soils, 10 percent Menominee soils, and 35 percent soils of minor extent.

Onaway soils are nearly level to very steep and are well drained and moderately well drained. Permeability generally is moderate or moderately slow throughout the profile. It is rapid, however, in the substratum of the sandy substratum phase. The available water capacity is high. Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown, very friable fine sandy loam about 6 inches thick. The next layer is mixed reddish brown, friable loam and brown, very friable fine sandy loam about 4 inches thick. The subsoil is mostly reddish brown, friable loam about 7 inches thick. The substratum to a depth of about 60 inches is brown, friable sandy loam.

Seelyeville soils are nearly level and very poorly drained. They are moderately rapidly permeable. The available water capacity is very high. Typically, the soils are muck to a depth of at least 60 inches. The muck is very dark gray in the upper part and black and very dark brown in the lower part.

Menominee soils are gently sloping to moderately steep and are well drained. They are rapidly permeable in the upper part and moderately permeable in the lower part. The available water capacity is moderate. Typically, the surface layer is dark brown loamy fine sand about 9 inches thick. The upper subsoil is strong brown, very friable fine sand about 8 inches thick. The next layer is brown, very friable loamy fine sand about 6 inches thick. The lower subsoil is dark reddish brown, firm clay loam about 6 inches thick. The substratum to a depth of about 60 inches is brown, friable sandy loam.

Some of the minor soils in this association are the Fairport, Iosco, Kiva, Markey, Menahga, and Solona soils. The well drained Fairport soils are underlain by dolomite at a depth of 20 to 40 inches. They are on ridgetops and convex side slopes. The somewhat poorly drained Iosco soils have a sandy mantle that is 20 to 40 inches thick. They are on low lying flats and in drainageways and depressions. The well drained Kiva soils are underlain by calcareous sand and gravel at a depth of 10 to 24 inches. They are on convex side slopes. The very poorly drained Markey soils formed in 16 to 51 inches of organic material and are underlain by sandy material. They are in drainageways and depressions and on low lying flats. The excessively drained Menahga soils are sandy throughout. They are on flats and convex side slopes. The somewhat poorly drained Solona soils are in drainageways and depressions and on concave foot slopes.

Most areas of the Onaway and Menominee soils are used for crops. Most areas of the Seelyeville soils and some of the steeper areas of the Onaway and Menominee soils are used as woodland. Most areas of the Onaway and Menominee soils and the adequately drained areas of the Seelyeville soils are suited to crops. Water erosion, wetness, and soil blowing are the main management concerns. Also, drought is a hazard in areas of the Menominee soils, and the length of the growing season, which is restricted by frost late in spring and early in fall, is a limitation in areas of the Seelyeville soils. The steep and very steep Onaway soils and undrained areas of the Seelyeville soils are generally unsuited to crops.

The major soils are suited to trees. Harvesting on the very poorly drained Seelyeville soils is restricted because of wetness.

The gently sloping and sloping, well drained Onaway and Menominee soils are suited to residential development. The moderately steep to very steep

Onaway soils and the moderately steep Menominee soils, however, are poorly suited because of the slope, and the Seelyeville soils are generally unsuited because of ponding.

7. Onaway-Solona Association

Nearly level to very steep, well drained to somewhat poorly drained, loamy soils on uplands

This association is on flats, on convex side slopes, and in drainageways and depressions on ground moraines. It makes up about 30 percent of the county. It is about 40 percent Onaway soils, 28 percent Solona soils, and 32 percent soils of minor extent.

Onaway soils are nearly level to very steep and are well drained and moderately well drained. They are moderately permeable and moderately slowly permeable. The available water capacity is high. Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown, very friable fine sandy loam about 6 inches thick. The next 4 inches is mixed reddish brown, friable loam and brown, very friable fine sandy loam. The subsoil is mostly reddish brown, friable loam about 7 inches thick. The substratum to a depth of about 60 inches is brown, friable sandy loam.

Solona soils are nearly level and gently sloping and are somewhat poorly drained. They are moderately permeable. The available water capacity is moderate. Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsoil is mottled, friable sandy loam about 13 inches thick. It is brown in the upper part and reddish brown in the lower part. The substratum to a depth of about 60 inches is reddish brown, mottled, friable sandy loam.

Some of the minor soils in this association are the Bonduel, Ensley, Fairport, Fence, Iosco, Menominee, Seelyeville, and Shiocton soils. The somewhat poorly drained Bonduel and well drained Fairport soils are underlain by dolomite at a depth of 20 to 40 inches. They are in drainageways and on ridgetops and side slopes. The poorly drained and very poorly drained Ensley soils are on low lying flats and in depressions and drainageways. The well drained Fence and somewhat poorly drained Shiocton soils formed in lacustrine deposits. They are on convex side slopes, on concave foot slopes, in drainageways and depressions, and on low lying flats. The somewhat poorly drained Iosco and well drained Menominee soils have a sandy mantle that is 20 to 40 inches thick. They are on convex side slopes, on flats, on concave foot slopes, and in drainageways and depressions. The very poorly drained Seelyeville soils formed in organic material on low lying flats and in drainageways and depressions.

Most areas are used for crops. Some are used as pasture or woodland. Most areas of the Onaway soils and adequately drained areas of the Solona soils are suited to crops, but the steep and very steep Onaway soils are generally unsuited. Water erosion and wetness are the main management concerns.

The major soils are suited to trees. The gently sloping, well drained Onaway soils are suited to residential development, and the sloping Onaway soils are moderately suited. The moderately steep to very steep Onaway soils are poorly suited because of the slope. The Solona soils are poorly suited to residential development because of the seasonal high water table.

8. Wainola-Cormant Association

Nearly level and gently sloping, somewhat poorly drained to very poorly drained, sandy soils on flats and in depressions and drainageways on outwash plains and glacial lake plains

This association makes up about 7 percent of the county. It is about 48 percent Wainola soils, 25 percent Cormant soils, and 27 percent soils of minor extent.

Wainola soils are nearly level and gently sloping and are somewhat poorly drained. They are rapidly permeable. The available water capacity is low. Typically, the surface layer is black loamy fine sand about 3 inches thick. The subsurface layer is brown, very friable fine sand about 6 inches thick. The subsoil is mottled, very friable fine sand about 21 inches thick. It is dark yellowish brown in the upper part and dark brown in the lower part. The substratum to a depth of about 60 inches is yellowish brown, mottled, loose fine sand.

Cormant soils are nearly level and are poorly drained and very poorly drained. They are rapidly permeable. The available water capacity is low. Typically, the surface layer is very dark gray loamy fine sand about 9 inches thick. The substratum to a depth of about 60 inches is mottled, loose fine sand. It is dark grayish brown in the upper part and grayish brown in the lower part.

Some of the minor soils in this association are the Brevort, Iosco, Rousseau, and Seelyeville soils and Saprists and Aquents, ponded. The poorly drained and very poorly drained Brevort and somewhat poorly drained Iosco soils are underlain by loamy deposits at a depth of 20 to 40 inches. They are on low lying flats and in drainageways and depressions. The moderately well drained Rousseau soils are on flats and side slopes. The very poorly drained Saprists and Aquents formed in organic material and in sandy and loamy deposits. They are along the edges of open bodies of water and in depressions. The very poorly drained Seelyeville soils formed in organic material. They are on low lying flats and in drainageways and depressions.

Most areas are undrained and support woodland or wetland vegetation. Some are drained and used for crops. Where adequately drained and protected from ponding and soil blowing, the major soils are suited to crops. Ponding and soil blowing are the main hazards. Wetness is the main limitation.

The major soils are suited to trees. They are poorly suited to residential development because of the seasonal high water table and the ponding.

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 of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Onaway fine sandy loam, 1 to 6 percent slopes, is a phase in the Onaway series.

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

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Onaway-Kiva-Menahga complex, 4 to 15 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Seelyeville and Markey mucks, 0 to 1 percent slopes, 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. Pits is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The detailed soil map units in Oconto County join with similar map units that may have different names in adjacent counties. Some differences result from variations in the extent or pattern of the soils in the counties. Others result from variations in the scale of the maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

AaE—Alpena gravelly sandy loam, 20 to 35 percent slopes. This steep and very steep, deep, excessively drained soil is on convex side slopes. Most areas are long and narrow and range from about 10 to 50 acres in size.

Typically, the surface layer is very dark gray gravelly sandy loam about 4 inches thick. The subsoil is dark brown, very friable very gravelly sandy loam about 4 inches thick. The substratum to a depth of about 60 inches is brown, loose, stratified sand and very gravelly sand. In some places the surface layer is loam, gravelly loam, or sandy loam. In other places the soil is moderately steep or is eroded. In some areas the loamy mantle is more than 10 inches thick.

Included with this soil in mapping are small areas of the excessively drained Menahga soils. These soils are in landscape positions similar to those of the Alpena soil. They are sandy throughout. They make up 10 to 15 percent of the unit.

Permeability is very rapid in the Alpena soil. The available water capacity is very low. Surface runoff is rapid. Organic matter content is moderate in the surface layer.

Most areas are wooded. Some are used as unimproved pasture. This soil is generally unsuited to cultivated crops and pasture because of the very low available water capacity, a very severe hazard of erosion, and the susceptibility to soil blowing.

This soil is poorly suited to trees. The trees grow slowly and tend to be poorly formed. Planting on the contour and carefully locating skid roads help to control erosion. Seedling survival rates are poor in dry periods. They can be improved by careful planting of vigorous nursery stock. The production of merchantable wood may not be profitable, but the cover of trees can be very effective in controlling soil blowing and erosion.

This soil is generally unsuited to septic tank absorption fields and dwellings because of the slope. This limitation is difficult to overcome, and a more suitable site should be selected. If the soil is used as a septic tank absorption field, a poor filtering capacity may result in the pollution of ground water. The soil is poorly suited to local roads because of the slope. Cutting and filling or constructing the roads on the contour helps to overcome this limitation.

The land capability classification is VIIs. The woodland ordination symbol is 3R.

BnA—Bonduel loam, 0 to 3 percent slopes. This nearly level and gently sloping, moderately deep, somewhat poorly drained soil is on low lying flats and in plane or concave drainageways. Most areas are irregular in shape and range from about 5 to 160 acres in size.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is dark brown and brown, mottled, friable loam about 17 inches thick. The substratum is light brown, mottled, friable loam about 12 inches thick. Light gray dolomite bedrock is at a depth of about 37 inches. In some places the surface layer is fine sandy loam or silt loam. In other places the soil is more than 40 inches deep over dolomite.

Included with this soil in mapping are small areas of Fairport and Solona soils. The somewhat poorly drained Solona soils are in positions on the landscape similar to those of the Bonduel soil. They do not have dolomite within a depth of 60 inches. The well drained Fairport soils are in the higher landscape positions. Also included are areas of soils that have dolomite within a depth of 20 inches. Included soils make up 5 to 10 percent of the unit.

Permeability and the available water capacity are moderate in the Bonduel soil. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 3 feet during wet periods. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled.

Drained areas are used for crops or pasture. Undrained areas provide wildlife habitat. In the drained areas this soil is suited to corn and small grain. Surface drains remove excess surface water rapidly. In areas where the depth to bedrock is sufficient, tile can improve subsurface drainage. Regular additions of organic material help to maintain fertility and good tilth.

If drained, this soil is suited to pasture and hay. Overgrazing reduces the extent of the protective plant cover and encourages the growth of undesirable plant species. Grazing during wet periods results in surface compaction and poor tilth and reduces the rate of water infiltration. Applications of fertilizer and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges if natural regeneration is unreliable. The use of equipment is restricted in the spring and other excessively wet periods. Ruts form easily when heavy, wheeled equipment is used during these periods. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

Because of the seasonal high water table and the moderate depth to dolomite, this soil is poorly suited to septic tank absorption fields. Mounding with suitable filtering material helps to overcome these limitations. The soil is poorly suited to dwellings without basements because of the seasonal high water table. This limitation can be overcome by installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, or by adding fill material, which raises the site. The soil is poorly suited to dwellings with basements because of the seasonal high water table and the depth to bedrock. Constructing the basement above the water table and installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, help to overcome the wetness. The bedrock can be excavated by blasting or by using suitable power equipment.

This soil is poorly suited to local roads and streets because of a high potential for frost action. This hazard can be overcome by installing a subsurface drainage system in the roadbed and by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIw. The woodland ordination symbol is 4W.

Bs—Brevort mucky loamy sand, 0 to 2 percent slopes. This nearly level, deep, poorly drained and very poorly drained soil is on low lying flats and in depressions and drainageways. It is subject to ponding. Most areas are irregular in shape and range from about 5 to 120 acres in size.

Typically, the surface layer is black mucky loamy sand about 9 inches thick. The upper part of the substratum is grayish brown, mottled, loose sand. The lower part to a depth of about 60 inches is brown, mottled, friable silt loam. In some places the surface layer is sand, fine sand, loamy sand, or loamy fine sand. In other places the soil has an organic surface layer as much as 16 inches thick.

Included with this soil in mapping are small areas of Iosco, Markey, and Wainola soils. The somewhat poorly drained Iosco and Wainola soils are in the slightly higher landscape positions. Wainola soils are dominantly fine sand throughout. The very poorly drained Markey soils are in positions on the landscape similar to those of the Brevort soil. They are organic to a depth of 16 to 51 inches. Also included are areas of soils that have more clay and less sand and silt in the substratum than the Brevort soil. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the upper part of the Brevort soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is very slow or ponded. The water table is above or near the surface throughout the year. It hinders root growth. Organic matter content is high or very high in the surface layer.

Drained areas are used for crops or pasture. Undrained areas provide wildlife habitat. Some are used as unimproved pasture. In the drained areas this soil is suited to corn and small grain. Surface drains remove excess surface water rapidly. Deep ditches and tile drains can improve internal drainage. Where drainage tile is installed in the sandy upper part of the soil, loose sand can enter the tile lines unless a suitable filter is used. Unless protected by a plant cover, ditchbanks are eroded by flowing water. Vertical banks can cave in and plug the ditch. If the soil is drained and cultivated, soil blowing is a hazard. It can be controlled by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; wind stripcropping; and field windbreaks.

Because of the high water table and the periodic ponding, undrained areas are unsuitable for most forage species. They can be used only for such species as reed canarygrass and Garrison creeping foxtail. Drained areas are better suited to legumes and grasses for hay and pasture. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poorer survival rate unless this soil is irrigated. Overgrazing reduces the extent of the protective plant cover and thus increases the susceptibility to soil blowing. Topdressing with suitable fertilizer and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Because of the wetness, trees should be planted by hand or machine on prepared ridges if natural regeneration is unreliable. Planting large, vigorous nursery stock reduces the seedling mortality rate. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is generally unsuited to dwellings because of the ponding and to septic tank absorption fields because of the ponding, the rapid permeability in the sandy mantle, and the moderately slow permeability in the lower part of the substratum. Overcoming these limitations is difficult, and a more suitable site should be selected. The soil is poorly suited to local roads because of the ponding and a high potential for frost action. Surface water can be removed by ditches and culverts, and fill material can raise the roads and streets above the ponding level. The damage caused by frost action can be minimized by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIIw. The woodland ordination symbol is 8W.

Co—Cormant loamy fine sand, 0 to 1 percent slopes. This nearly level, deep, poorly drained and very poorly drained soil is on low lying flats and in depressions and drainageways. It is subject to ponding. Most areas are irregular in shape and range from about 5 to 280 acres in size.

Typically, the surface layer is very dark gray loamy fine sand about 9 inches thick. The substratum to a depth of about 60 inches is mottled, loose fine sand. It is dark grayish brown in the upper part and grayish brown in the lower part. In some places the surface layer is mucky loamy fine sand, loamy sand, or sand. In other places the soil has an organic surface layer as much as 16 inches thick.

Included with this soil in mapping are small areas of Brevort, Markey, and Wainola soils. The poorly drained and very poorly drained Brevort and very poorly drained Markey soils are in positions on the landscape similar to those of the Cormant soil. Brevort soils have a sandy mantle that is 20 to 40 inches deep over silty or loamy deposits. Markey soils are organic to a depth of 16 to 51 inches and are underlain by sandy deposits. The somewhat poorly drained Wainola soils are in the slightly higher positions on the landscape. Included soils make up 10 to 15 percent of the unit.

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

ponded. Unless the soil is drained, the water table is above or near the surface throughout the year. It hinders root growth. Organic matter content is high or very high in the surface layer.

Most areas are undrained and are unsuited to crops. They provide wildlife habitat. Some are used as unimproved pasture. A few areas have been drained and are used for corn or small grain. If the soil is drained and cultivated, soil blowing is a hazard.

Undrained areas are unsuitable for most forage plants. They can be used only for such species as reed canarygrass and Garrison creeping foxtail. Drained areas are better suited to legumes and grasses for hay and pasture. Forage yields generally are low unless fertilizer and irrigation water are applied. In drained areas the best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poorer survival rate unless the soil is irrigated. Overgrazing reduces the extent of the protective plant cover and thus increases the susceptibility to soil blowing. Topdressing with suitable fertilizer and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges if natural regeneration is unreliable. Planting vigorous nursery stock reduces the seedling mortality rate. The use of equipment is restricted in the spring and other excessively wet periods. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is generally unsuited to septic tank absorption fields because of the ponding and the rapid permeability and to dwellings because of the ponding. Overcoming these limitations is difficult, and a more suitable site should be selected. The soil is poorly suited to local roads and streets because of the ponding. Surface water can be removed by culverts and ditches, and fill material can raise the roads and streets above the ponding level.

The land capability classification is VIw. The woodland ordination symbol is 4W.

Es—Ensley mucky loam, 0 to 2 percent slopes. This nearly level, deep, poorly drained and very poorly drained soil is on low lying flats and in depressions and drainageways. It is subject to ponding. Most areas are irregular in shape and range from about 4 to 100 acres in size.

Typically, the surface layer is black mucky loam about 7 inches thick. The subsurface layer is grayish brown, mottled, friable silt loam about 5 inches thick. The subsoil is mottled, firm sandy loam about 15 inches thick. The upper part is dark brown, and the lower part is reddish brown. The substratum to a depth of about 60 inches is brown and reddish brown, mottled, friable sandy loam. In some places the surface layer is silt loam or sandy loam. In other places the soil has an organic surface layer as much as 16 inches thick.

Included with this soil in mapping are small areas of Brevort, Minocqua, and Solona soils. The poorly drained and very poorly drained Brevort and Minocqua soils are in positions on the landscape similar to those of the Ensley soil. Brevort soils have a sandy mantle that is 20 to 40 inches thick. Minocqua soils are underlain by sand. The somewhat poorly drained Solona soils are in the slightly higher landscape positions. Also included are small areas of soils that have more clay in the subsoil than the Ensley soil and small areas where dolomite bedrock is at a depth of 40 to 60 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Ensley soil and moderately rapid in the lower part. The available water capacity is high. Surface runoff is slow to ponded. The seasonal high water table is above or near the surface much of the year. It hinders root growth. Organic matter content is high in the surface layer. This layer is friable and can be easily tilled, but it tends to crust after heavy rains.

Most drained areas are used for crops. Undrained areas provide wildlife habitat. Some are used as unimproved pasture. In the drained areas this soil is suited to corn and small grain. Surface drains remove excess surface water rapidly. Deep ditches and tile drains can improve subsurface drainage. Unless protected by vegetation, ditchbanks are easily eroded by flowing water. Vertical banks can cave in and plug the ditch.

Because of the high water table and the periodic ponding, undrained areas are unsuitable for most forage species. They can be used only for such species as reed canarygrass and Garrison creeping foxtail. Drained areas are suited to certain legumes and grasses. Overgrazing reduces the extent of the protective plant cover and encourages the growth of undesirable plant species. Grazing when the surface layer is wet results in surface compaction and poor tilth and reduces the rate of water infiltration. Applications of fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges if natural regeneration is unreliable. Planting vigorous nursery stock reduces the seedling mortality rate. The use of equipment is restricted in the spring and other excessively wet periods. Ruts form easily when heavy, wheeled equipment is used during these periods. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes

with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

Because of the ponding, this soil is generally unsuited to septic tank absorption fields and dwellings. Overcoming this limitation is difficult, and a more suitable site should be selected. The soil is poorly suited to local roads because of the ponding and a high potential for frost action. Surface water can be removed by ditches and culverts, and fill material can raise the roads and streets above ponding level. The damage caused by frost action can be minimized by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIw. The woodland ordination symbol is 3W.

FpB—Fairport fine sandy loam, 2 to 6 percent slopes. This gently sloping, moderately deep, well drained soil is on plane or convex ridgetops and on convex side slopes. Most areas are irregular in shape and range from about 5 to 160 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The next 3 inches is mixed dark brown, firm loam and brown, friable fine sandy loam. The subsoil is dark reddish brown and reddish brown, firm loam about 14 inches thick. Dolomite bedrock is at a depth of about 25 inches. In some places the surface layer is silt loam or sandy loam. In other places the depth to dolomite is more than 40 inches.

Included with this soil in mapping are small areas of Bonduel and Summerville soils. The somewhat poorly drained Bonduel soils are in depressions and drainageways. The well drained Summerville soils are in positions on the landscape similar to those of the Fairport soil. They have dolomite within a depth of 20 inches. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Fairport soil. The available water capacity is low. Surface runoff is medium in cultivated areas. Root penetration is restricted by the underlying dolomite. Organic matter content is moderately low or moderate in the surface layer. This layer is friable and can be easily tilled.

Most areas are used for crops or pasture. Some small areas are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay or pasture. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Returning crop residue to the soil or regularly adding other organic material helps to maintain fertility, reduces the susceptibility to erosion, and increases the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion. Overgrazing, however, reduces the extent of the protective cover and thus increases the susceptibility to erosion. Grazing when the surface layer is wet results in surface compaction and poor tilth and increases the rate of runoff and the hazard of erosion. Topdressing with suitable fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

Because of the moderate depth to dolomite, this soil is poorly suited to septic tank absorption fields. Mounding with suitable filtering material helps to overcome this limitation. The soil is only moderately suited to dwellings without basements because of the depth to bedrock and the shrink-swell potential. Excavating the bedrock by blasting and then backfilling with coarse textured material, such as sand or gravel, help to overcome these limitations. These measures result in a level base deep enough for footings. The soil is poorly suited to dwellings with basements because of the depth to bedrock. Excavating the bedrock by blasting or adding fill material, which raises the site, helps to overcome this limitation.

This soil is poorly suited to local roads and streets because of low strength. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to overcome this limitation.

The land capability classification is IIe. The woodland ordination symbol is 3A.

FpC—Fairport fine sandy loam, 6 to 12 percent slopes. This sloping, moderately deep, well drained soil is on convex ridgetops and side slopes. Most areas are irregular in shape and range from about 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The next 6 inches is mixed brown, friable fine sandy loam and dark reddish brown, friable loam. The subsoil is about 20 inches thick. The upper part is dark reddish brown, firm loam, and the lower part is reddish brown, friable sandy loam. Dolomite bedrock is at a depth of about 34 inches. Some small areas are eroded. In some places the surface layer is loam or sandy loam. In other places the depth to dolomite is more than 40 inches.

Included with this soil in mapping are small areas of the well drained Onaway and Summerville soils. These soils are in positions on the landscape similar to those of the Fairport soil. Onaway soils do not have dolomite within a depth of 60 inches. Summerville soils have dolomite within a depth of 20 inches. Also included are areas where the slope is more than 12 percent and

areas where the soil is severely eroded. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Fairport soil. The available water capacity is low. Surface runoff is medium in cultivated areas. Root penetration is restricted by the underlying dolomite. Organic matter content is moderately low or moderate in the surface layer. This layer is friable and can be easily tilled.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Grazing when the surface layer is wet results in surface compaction and poor tilth and increases the runoff rate and the hazard of erosion. Topdressing with suitable fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

Because of the moderate depth to dolomite, this soil is poorly suited to septic tank absorption fields. Mounding with suitable filtering material helps to overcome this limitation. The soil is only moderately suited to dwellings without basements because of the slope, the depth to bedrock, and the shrink-swell potential. Excavating the bedrock by blasting and then backfilling with coarse textured material, such as sand or gravel, help to overcome the depth to bedrock and the shrink-swell potential. These measures result in a level base deep enough for footings. Cutting and filling can overcome the slope, but the bedrock may prohibit cuts of adequate depth. The soil is poorly suited to dwellings with basements because of the depth to bedrock. Excavating the bedrock or adding fill material, which raises the site, helps to overcome this limitation.

This soil is poorly suited to local roads and streets because of low strength. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to overcome this limitation.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

FsB—Fence very fine sandy loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 5 to 100 acres in size.

Typically, the surface layer is dark brown very fine sandy loam about 7 inches thick. The upper subsoil is brown, friable very fine sandy loam about 4 inches thick. The next 8 inches is brown, friable very fine sandy loam and mixed brown, friable very fine sandy loam and reddish brown, friable silt loam. The lower subsoil is reddish brown, friable silt loam about 14 inches thick. The substratum to a depth of about 60 inches is brown, very friable, stratified silt and very fine sand. In some areas the surface layer is sandy loam, loam, or silt loam. In some places the depth to the stratified substratum is more than 40 inches. In other places the substratum is silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Shiocton and poorly drained Waupaca soils in depressions and drainageways. Also included are areas where the depth to the water table is as shallow as 3 feet during wet periods, areas where the slope is more than 6 percent, and some areas of soils that have more sand and less silt in the subsoil than the Fence soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Fence soil. The available water capacity is high. Surface runoff is slow or medium in cultivated areas. Organic matter content is low in the surface layer. This layer is friable and can be easily tilled.

Most areas are used for crops or pasture. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Grazing when the surface layer is wet results in surface compaction and increases the runoff rate and the hazard of erosion. Topdressing with suitable fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

Because of the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Mounding with suitable filtering material or enlarging the absorption field helps to overcome this limitation. The soil is suited to dwellings. It is poorly suited to local roads and streets because of a high potential for frost action. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 3A.

FsC—Fence very fine sandy loam, 6 to 12 percent slopes. This sloping, deep, well drained soil is on convex side slopes and knolls. Most areas are irregular in shape and range from about 5 to 25 acres in size.

Typically, the surface layer is black very fine sandy loam about 4 inches thick. The upper subsoil is dark brown, friable very fine sandy loam about 4 inches thick. The next 11 inches is brown, friable very fine sandy loam and mixed brown, friable very fine sandy loam and reddish brown, friable silt loam. The lower subsoil is strong brown, friable silt loam about 11 inches thick. The substratum to a depth of about 60 inches is yellowish brown, friable very fine sandy loam that has thin strata of fine sand and sand. In some places the surface layer is silt loam, fine sandy loam, or loam. In other places the substratum is silty clay loam.

Included with this soil in mapping are small areas of the moderately well drained Rousseau and somewhat poorly drained Shiocton soils in drainageways and depressions. Rousseau soils are sandy throughout. Also included are areas of soils that have more sand and less silt in the substratum than the Fence soil, areas where the slope is less than 6 or more than 12 percent, and areas where the soil is severely eroded. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Fence soil. The available water capacity is high. Surface runoff is medium in cultivated areas. Organic matter content is low in the surface layer. This layer is friable and can be easily tilled.

Most areas are used for crops or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Grazing when the surface layer is wet results in surface compaction and increases the runoff rate and the hazard of erosion. Topdressing with suitable fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

Because of the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Mounding with suitable filtering material or enlarging the absorption field helps to overcome this limitation. The soil is only moderately suited to dwellings because of the slope. Cutting and filling can overcome this limitation. Also, the dwellings can be designed so that they conform to the natural slope of the land.

This soil is poorly suited to local roads and streets because of a high potential for frost action. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

IsA—Iosco loamy fine sand, 0 to 3 percent slopes. This nearly level and gently sloping, deep, somewhat poorly drained soil is on low lying flats, in drainageways and depressions, and on concave foot slopes. Most areas are irregular in shape and range from about 5 to 200 acres in size.

Typically, the surface layer is very dark brown loamy fine sand about 10 inches thick. The subsoil is about 24 inches thick. The upper part is dark brown, mottled, very friable loamy fine sand, and the lower part is brown, mottled, friable loam. The substratum to a depth of about 60 inches is reddish brown, mottled, friable sandy loam. In some places the surface layer is loamy sand, sand, or fine sand. In other places the upper part of the subsoil is sand. In some areas the sandy mantle is more than 40 inches thick.

Included with this soil in mapping are small areas of Brevort, Shiocton, Solona, and Wainola soils. The poorly drained and very poorly drained Brevort soils are in depressions and drainageways. Shiocton, Solona, and Wainola soils are in positions on the landscape similar to those of the Iosco soil. Solona and Shiocton soils are loamy throughout. Wainola soils are sandy throughout. Also included are some areas where the Iosco loamy fine sand is underlain by silty clay or gravelly and cobbly sandy loam and some areas where sand and gravel are below a depth of 50 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the upper part of the Iosco soil and moderate in the lower part. The available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 3 feet during wet periods. It hinders root growth in wet periods during the growing season. Organic matter content is moderate in the surface layer.

Drained areas are used for crops or pasture. Undrained areas provide wildlife habitat. Some are used as unimproved pasture. Some are wooded. In the drained areas this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Surface drains remove excess surface water rapidly. Deep ditches and tile drains can improve subsurface drainage. Where drainage tile is installed in the sandy mantle, the tile lines can become plugged unless a suitable filter is used. Vertical ditchbanks can cave in and plug the ditch. Erosion generally is not a problem. If the soil is drained and cultivated, soil blowing is a hazard. It can be controlled by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; wind stripcropping; and field windbreaks. Regular additions of organic material help to maintain fertility and good tilth.

A cover of hay or pasture plants is effective in controlling soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and increases the susceptibility to soil blowing. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poorer survival rate unless the soil is irrigated. Topdressing with appropriate fertilizer and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

Because of the seasonal high water table, this soil is poorly suited to septic tank absorption fields. Mounding with suitable filtering material helps to overcome this limitation. The soil is poorly suited to dwellings because of the seasonal high water table. This limitation can be overcome by installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, or by adding fill material, which raises the site.

This soil is poorly suited to local roads and streets because of a high potential for frost action. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIIw. The woodland ordination symbol is 3S.

KaB—Kennan fine sandy loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 5 to 50 acres in size.

Typically, the surface layer is brown fine sandy loam about 1 inch thick. The upper subsoil is dark brown, friable fine sandy loam about 11 inches thick. The next 10 inches is mixed dark brown, friable sandy loam and brown, friable fine sandy loam. The lower subsoil is reddish brown, friable sandy loam about 11 inches thick. The substratum to a depth of about 60 inches is brown, friable sandy loam. In some places the surface layer is loamy sand. In other places the soil has a silty mantle as much as 30 inches thick. In some areas strata of clay are in the substratum.

Included with this soil in mapping are small areas of Keweenaw, Padus, and Worcester soils. The well drained Keweenaw and Padus soils are in positions on the landscape similar to those of the Kennan soil. Keweenaw soils formed in sandy drift. Padus soils have a loamy mantle that is 24 to 40 inches deep over outwash of sand and gravel. The somewhat poorly drained Worcester soils are in depressions. They are underlain by outwash of sand and gravel. Also included are areas where the slope is more than 6 percent, areas where the soil is very stony, and some small areas where the depth to the water table is as shallow as 3 feet during wet periods. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Kennan soil and moderate or moderately rapid in the lower part. The available water capacity is moderate. Surface runoff is slow or medium. Organic matter content is moderately low or moderate in the surface layer. This layer is friable and can be easily tilled.

Most areas are wooded. Some are used for crops or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Topdressing with suitable fertilizer and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. The vegetation that competes with natural regeneration following harvest can be controlled by suitable herbicides or mechanical removal. Where stones prevent the use of machinery, hand planting is needed.

This soil is suited to septic tank absorption fields and dwellings. It is only moderately suited to local roads and streets because of a moderate potential for frost action. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 3A.

KaC—Kennan fine sandy loam, 6 to 15 percent slopes. This sloping and moderately steep, deep, well drained soil is on convex side slopes and ridgetops. Most areas are irregular in shape and range from about 5 to 300 acres in size.

Typically, the surface layer is black fine sandy loam about 3 inches thick. The subsurface layer is brown fine sandy loam about 2 inches thick. The upper subsoil is dark brown, friable fine sandy loam about 9 inches thick. The next 21 inches is mixed brown, friable fine sandy loam and dark brown, friable sandy loam. The lower subsoil is reddish brown, friable sandy loam about 13 inches thick. The substratum to a depth of about 60 inches is reddish brown, friable sandy loam. In some places the surface layer is loamy sand. In other places the soil has a silty mantle as much as 30 inches thick.

Included with this soil in mapping are small areas of Keweenaw, Minocqua, and Padus soils. The well drained Keweenaw and Padus soils are in positions on the landscape similar to those of the Kennan soil. Keweenaw soils formed in sandy drift. Padus soils have a loamy mantle that is 24 to 40 inches deep over outwash of sand and gravel. The poorly drained and very poorly drained Minocqua soils are in depressions. They are underlain by outwash of sand or gravelly sand. Also included are areas where the slope is less than 6 or more than 15 percent and areas where the soil is very stony. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Kennan soil and moderate or moderately rapid in the lower part. The available water capacity is moderate. Surface runoff is medium or rapid. Organic matter content is moderately low or moderate in the surface layer. This layer is friable and can be easily tilled.

Most areas are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; use of a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and increases the susceptibility to erosion and soil blowing. Topdressing with suitable fertilizer and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. The vegetation that competes with natural regeneration following harvest can be controlled by suitable herbicides or mechanical removal. Where stones prevent the use of machinery, hand planting is needed.

Because of the slope, this soil is only moderately suited to septic tank absorption fields and dwellings. Cutting and filling can overcome this limitation. Also, the dwellings can be designed so that they conform to the natural slope of the land. The soil is only moderately suited to local roads and streets because of the slope and a moderate potential for frost action. Cutting and filling help to overcome the slope. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

KaD—Kennan fine sandy loam, 15 to 30 percent slopes. This moderately steep and steep, deep, well drained soil is on convex side slopes and ridgetops. Most areas are irregular in shape and range from about 5 to 80 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 2 inches thick. The upper subsoil is dark brown, friable fine sandy loam about 14 inches thick. The next 12 inches is mixed brown, friable fine sandy loam and reddish brown, friable sandy loam. The lower subsoil is about 11 inches of reddish brown, friable sandy loam and reddish brown, very friable loamy sand. The substratum to a depth of about 60 inches is brown, very friable loamy sand. In some places the surface layer is loamy sand. In other places the soil has a silty mantle as much as 30 inches thick.

Included with this soil in mapping are small areas of Keweenaw, Minocqua, and Pence soils. The well drained Keweenaw and Pence soils are in positions on the landscape similar to those of the Kennan soil. Keweenaw soils formed in sandy drift. Pence soils have a loamy mantle that is 12 to 24 inches deep over outwash of sand and gravel. The poorly drained and very poorly drained Minocqua soils are in depressions. They are underlain by outwash of sand or gravelly sand. Also included are areas where the slope is less than 30 percent and areas where the soil is very stony. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Kennan soil and moderate or moderately rapid in the lower part. The available water capacity is moderate. Surface runoff is rapid or very rapid. Organic matter

content is moderately low or moderate in the surface layer.

Most areas are wooded. Because of a very severe hazard of erosion, this soil is generally unsuitable for cultivated crops. It is suited to pasture and hay. Erosion generally is not a problem unless overgrazing reduces the extent of the protective plant cover. Topdressing with suitable fertilizer and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. Erosion is a hazard because runoff concentrates on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water by out-sloping road surfaces, culverts, and drop structures minimizes erosion. Building roads on the contour or on the gentler slopes also helps to control erosion. Seeding roads, trails, and landings after logging helps to establish a protective vegetative cover. The use of equipment is restricted because of the slope. Special care is needed in laying out roads and landings and in operating equipment. During wet periods, unsurfaced roads tend to be slippery and ruts form easily. Year-round roads should be graveled. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

Because of the slope, this soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets. Cutting and filling can overcome a slope of less than 20 percent. Dwellings can be designed so that they conform to the natural slope of the land. Septic tank absorption fields and local roads and streets can be constructed on the contour. A slope of more than 20 percent is difficult to overcome, and a more suitable site should be selected.

The land capability classification is VIe. The woodland ordination symbol is 3R.

KeB—Keweenaw loamy fine sand, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 20 to 160 acres in size.

Typically, the surface layer is dark brown loamy fine sand about 3 inches thick. The subsoil is very friable loamy fine sand about 31 inches thick. The upper part is dark reddish brown and reddish brown, and the lower part is strong brown and brown. The next 16 inches is mixed reddish brown, friable sandy loam and brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is brown, very friable loamy sand. In places the surface layer is sand, loamy sand, or fine sandy loam.

Included with this soil in mapping are small areas of the well drained Kennan and Padus soils. These soils are in positions on the landscape similar to those of the Keweenaw soil. Kennan soils have a loamy mantle and are underlain by sandy loam or loamy sand. Padus soils have a loamy mantle that is 24 to 40 inches deep over outwash of sand and gravel. Also included are areas where the slope is more than 6 percent, areas where stones and boulders are on the surface, and areas where the depth to the water table is as shallow as 3 feet. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the Keweenaw soil. The available water capacity is low. Surface runoff is slow. Organic matter content is low or moderately low in the surface layer.

Most areas are wooded. Some are used for crops or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. During most years, however, crop yields are limited by the low available water capacity. The soil is suited to sprinkler irrigation. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Yields generally are low unless fertilizer and irrigation water are applied. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poor survival rate unless the soil is irrigated. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. The vegetation that competes with natural regeneration following harvest can be controlled by suitable herbicides or mechanical removal. Planting vigorous nursery stock can reduce seedling losses.

This soil is suited to septic tank absorption fields, dwellings, and local roads and streets.

The land capability classification is IIIe. The woodland ordination symbol is 3S.

KeC—Keweenaw loamy fine sand, 6 to 15 percent slopes. This sloping and moderately steep, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 10 to 150 acres in size.

Typically, the surface layer is very dark gray loamy fine sand about 3 inches thick. The subsurface layer is reddish gray loamy fine sand about 1 inch thick. The subsoil is very friable loamy sand about 16 inches thick. The upper part is yellowish red, and the lower part is brown. The next 11 inches is mixed dark brown, friable sandy loam and brown, very friable loamy sand. The substratum to a depth of about 60 inches is brown, very

friable loamy sand. In some places the surface layer is fine sandy loam, loamy sand, or sand. In other places the substratum has pockets of sandy loam. In some areas the soil is underlain by very cobbly loamy sand.

Included with this soil in mapping are small areas of the well drained Kennan and Pence soils. These soils are in positions on the landscape similar to those of the Keweenaw soil. Kennan soils have a loamy mantle that is underlain by sandy loam or loamy sand. Pence soils have a loamy mantle that is 12 to 24 inches deep over sand and gravel. Also included are areas where the slope is less than 6 or more than 15 percent and areas where the soil is very stony. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the Keweenaw soil. The available water capacity is low. Surface runoff is medium. Organic matter content is low or moderately low in the surface layer.

Most areas are wooded. Some of these areas have been planted to pine. Some areas are used for crops or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. During most years, however, crop yields are limited by the low available water capacity. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are limited by the low available water capacity. The best planting time is early in spring, before the surface layer dries out. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. The vegetation that competes with natural regeneration following harvest can be controlled by suitabie herbicides or mechanical removal. Planting vigorous nursery stock can reduce seedling losses.

This soil is only moderately suited to septic tank absorption fields, dwellings, and local roads and streets because of the slope. Cutting and filling can overcome this limitation.

The land capability classification is IIIe. The woodland ordination symbol is 3S.

KeD—Keweenaw loamy fine sand, 15 to 35 percent slopes. This moderately steep to very steep, deep, well drained soil is on convex side slopes. Most areas are long and narrow and range from about 15 to 100 acres in size.

Typically, the surface layer is brown loamy fine sand about 1 inch thick. The subsoil is dark brown and strong brown, very friable loamy fine sand about 19 inches thick. The next 10 inches is mixed reddish brown, friable fine sandy loam and brown, very friable loamy fine sand. The substratum to a depth of about 60 inches is brown, loose loamy sand. In some places the surface layer is fine sandy loam, loamy sand, or sand. In other places the substratum is very cobbly loamy sand.

Included with this soil in mapping are small areas of the well drained Kennan and Pence soils. These soils are in positions on the landscape similar to those of the Keweenaw soil. Kennan soils have a loamy mantle that is underlain by sandy loam or loamy sand. Pence soils have a loamy mantle that is 12 to 24 inches deep over sand and gravel. Also included are areas where the slope is less than 15 percent and areas where the soil is very stony. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the Keweenaw soil. The available water capacity is low. Surface runoff is rapid. Organic matter content is low or moderately low in the surface layer.

Most areas are wooded. Some of these areas have been planted to pine. Because of the low available water capacity, a severe hazard of erosion, and the hazard of soil blowing, this soil generally is unsuitable for cultivated crops.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are limited by the low available water capacity. The best planting time is early in spring, before the surface layer dries out.

This soil is suited to trees. Erosion is a hazard because runoff concentrates on skid trails, logging roads, and landings. Removing water by out-sloping road surfaces, culverts, and drop structures minimizes erosion. Seeding disturbed areas after logging helps to establish a protective vegetative cover. The slope can interfere with the traction of wheeled equipment. Building roads on the contour or on the gentler slopes helps to overcome this limitation. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal. Seedling survival, especially on slopes facing south and west, can be improved by planting high-quality, vigorous seedlings.

This soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets because of the slope. Cutting and filling can overcome a slope of less than 20 percent. Dwellings can be designed so that they conform to the natural slope of the land. Septic tank absorption fields and local roads and streets can be

constructed on the contour. A slope of more than 20 percent is difficult to overcome, and a more suitable site should be selected.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

KvB—Kiva sandy loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 80 acres in size.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. The subsoil is reddish brown, friable sandy loam about 5 inches thick. The substratum to a depth of about 60 inches is brown and yellowish brown, loose gravelly sand and very gravelly sand. In places the surface layer is loam or loamy sand.

Included with this soil in mapping are small areas of Oconto, Onaway, and Worcester soils. The well drained Oconto and well drained and moderately well drained Onaway soils are in positions on the landscape similar to those of the Kiva soil. Oconto soils have a loamy mantle that is 24 to 40 inches thick. Onaway soils are loamy throughout. The somewhat poorly drained Worcester soils are in depressions and drainageways. Also included are areas where the slope is more than 6 percent. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Kiva soil and very rapid in the lower part. The available water capacity is low. Surface runoff is slow in cultivated areas. The droughtiness of the underlying sand and gravel generally hinders root growth. Organic matter content is low or moderately low in the surface layer. This layer is very friable and can be easily tilled.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain. During most years, however, crop yields are limited by the low available water capacity. If irrigated and intensively managed, the soil can produce better and more consistent yields. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and increase the rate of water infiltration.

This soil is suited to pasture and hay. Forage yields are generally somewhat limited, however, unless the soil is irrigated and fertilizer is applied. Erosion and soil blowing generally are not problems unless overgrazing reduces the extent of the protective plant cover. Topdressing with suitable fertilizer and controlled grazing help to maintain the plant cover.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is suited to dwellings and to local roads and streets.

The land capability classification is IIIs. The woodland ordination symbol is 3A.

KvC—Kiva sandy loam, 6 to 15 percent slopes. This sloping and moderately steep, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 40 acres in size.

Typically, the surface layer is very dark brown sandy loam about 7 inches thick. The subsoil is very friable sandy loam about 15 inches thick. The upper part is brown, and the lower part is dark reddish brown. The substratum to a depth of about 60 inches is dark yellowish brown, loose very gravelly sand. In some places the surface layer is loam or loamy sand. In other places the loamy mantle is less than 10 inches thick.

Included with this soil in mapping are small areas of the excessively drained Menahga and well drained Oconto and Onaway soils. These soils are in positions on the landscape similar to those of the Kiva soil. Menahga soils are sandy throughout. Oconto soils have a loamy mantle that is 24 to 40 inches thick. Onaway soils are loamy throughout. Also included are areas where the slope is more than 15 percent. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Kiva soil and very rapid in the lower part. The available water capacity is low. Surface runoff is medium in cultivated areas. The droughtiness of the underlying sand and gravel generally hinders root growth. Organic matter content is low or moderately low in the surface layer. This layer is very friable and can be easily tilled.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. During most years, however, crop yields are limited by the low available water capacity. If irrigated and intensively managed, the soil can produce better and more consistent yields. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces

the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are somewhat limited unless fertilizer and irrigation water are applied. Topdressing with suitable fertilizer and controlled grazing help to maintain the plant cover.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is only moderately suited to dwellings and to local roads and streets because of the slope. Cutting and filling can overcome this limitation. Dwellings can be designed so that they conform to the natural slope of the land. Constructing roads on the contour helps to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol is 3A.

KvD—Kiva sandy loam, 15 to 35 percent slopes. This moderately steep to very steep, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 5 to 250 acres in size.

Typically, the surface layer is very dark brown sandy loam about 3 inches thick. The subsoil is about 13 inches thick. It is brown and friable. The upper part is sandy loam, and the lower part is gravelly sandy loam. The substratum to a depth of about 60 inches is strong brown, loose, stratified coarse sand and very gravelly sand. In some places the surface layer is loam or loamy sand. In other places the loamy mantle is less than 10 inches thick.

Included with this soil in mapping are small areas of the excessively drained Menahga and well drained Oconto and Onaway soils. These soils are in positions on the landscape similar to those of the Kiva soil. Menahga soils are sandy throughout. Oconto soils have a loamy mantle that is 24 to 40 inches thick. Onaway soils are loamy throughout. Also included are areas where the slope is less than 15 percent. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Kiva soil and very rapid in the lower part. The available water capacity is low. Surface runoff is very rapid in cultivated areas. The droughtiness underlying sand and gravel generally hinders root growth. Organic matter content is low or moderately low in the surface layer.

Most areas are wooded. Some are used as pasture. Because of the low available water capacity, the hazard of soil blowing, and a very severe hazard of erosion, this soil generally is unsuited to cultivated crops. It is suited to pasture. Forage yields generally are limited, however, by the low available water capacity. Overgrazing reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Erosion is a hazard because runoff concentrates on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water by out-sloping road surfaces, culverts, and drop structures minimizes erosion. Building roads on the contour or on the gentler slopes also helps to control erosion. Seeding roads, trails, and landings after logging helps to establish a protective vegetative cover. The use of equipment is restricted because of the slope. Special care is needed in laying out roads and landings and in operating equipment. During wet periods, unsurfaced roads tend to be slippery and ruts form easily. Year-round roads should be graveled. Seedling survival can be improved by planting vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets because of the slope. Cutting and filling can overcome a slope of less than 20 percent. Dwellings can be designed so that they conform to the natural slope of the land. Septic tank absorption fields and local roads and streets can be constructed on the contour. A slope of more than 20 percent is difficult to overcome, and a more suitable site should be selected. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

Lx—Loxley mucky peat, 0 to 1 percent slopes. This nearly level, deep, very poorly drained soil is on low lying flats in depressions and drainageways. It is subject to ponding. Most areas are irregular in shape and range from about 3 to 80 acres in size.

Typically, the organic material is at least 60 inches thick. It is dark reddish brown mucky peat in the upper part, dark reddish brown muck in the next part, and black and very dark brown muck in the lower part.

Included with this soil in mapping are small areas of the very poorly drained Markey soils. These soils are in positions on the landscape similar to those of the Loxley soil. They formed in organic material less than 51 inches deep over sandy deposits. They make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Loxley soil. The available water capacity is very high. The water table is above or near the surface throughout the year. It hinders root growth. The organic matter content is very high in the surface layer. If the soil is drained, the organic matter decomposes and subsidence occurs.

Most areas are undrained and support low-growing native vegetation. This soil generally is unsuited to cultivated crops. The undrained areas provide wildlife habitat. Some are used as unimproved pasture. Some drained areas can be used for recreational purposes. The growing season is limited by frost late in spring and early in fall. The drained areas are subject to burning, and the cultivated areas are subject to soil blowing. Excessive lowering of the water table increases the extent of subsidence.

Because of the high water table, the periodic ponding, and a low fertility level, undrained areas are unsuitable for most forage species. Reed canarygrass can be grown in these areas. Some legumes, such as red clover, can be grown in drained areas. The low strength of the soil, however, restricts the use of machinery and limits grazing.

Because of the extremely acid soil conditions and the high water table, this soil is generally unsuited to trees. It does not support trees of merchantable size or quality. A few scattered black spruce, jack pine, quaking aspen, and tamarack grow on the soil.

This soil is generally unsuited to septic tank absorption fields because of the ponding, to dwellings because of the ponding and low strength, and to local roads and streets because of the ponding and a high potential for frost action. Overcoming these limitations is difficult, and a more suitable site should be selected.

The land capability classification is VIw. The woodland ordination symbol is 2W.

McB—Mancelona loamy sand, 1 to 6 percent slopes. This nearly level and gently sloping, deep, somewhat excessively drained soil is on flats and convex side slopes. Most areas are irregular in shape and range from about 3 to 300 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is about 21 inches thick. The upper part is strong brown and dark brown, very friable sand, and the lower part is dark brown, firm sandy clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, loose very gravelly sand. In places the lower part of the subsoil is sandy loam or loam.

Included with this soil in mapping are small areas of Kiva, Rousseau, and Wainola soils. The well drained Kiva soils are in positions on the landscape similar to those of Mancelona soil. They have a loamy mantle that is 10 to 24 inches thick. Rousseau and Wainola soils are sandy throughout. The moderately well drained Rousseau soils are in the slightly lower areas, and the somewhat poorly drained Wainola soils are in the lower areas. Also included are areas where the depth to the water table is as shallow as 3 feet during wet periods. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Mancelona soil and very rapid in the lower part. The available water capacity is low. Surface runoff is slow in cultivated areas. The droughtiness of the underlying sand and gravel generally hinders root growth. Organic matter content is low or moderately low in the surface layer.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. If irrigated, it can produce better and more consistent yields. If the soil is cultivated, erosion is a slight hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; wind stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to soil blowing. Forage yields generally are somewhat limited unless the soil is irrigated. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poor survival rate unless the soil is irrigated. Topdressing with suitable fertilizer and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is suited to dwellings and to local roads and streets.

The land capability classification is IIIs. The woodland ordination symbol is 3S.

McC—Mancelona loamy sand, 6 to 15 percent slopes. This sloping and moderately steep, deep, somewhat excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 120 acres in size.

Typically, the surface layer is black loamy sand about 3 inches thick. The subsurface layer is brown sand about 3 inches thick. The subsoil is about 16 inches thick. The upper part is dark yellowish brown and yellowish brown, very friable sand, and the lower part is strong brown, friable gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly sand. In places the lower part of the subsoil is loamy sand, sandy loam, or loam.

Included with this soil in mapping are small areas of Kiva and Menahga soils. These soils are in landscape positions similar to those of the Mancelona soil. Kiva

soils have a loamy mantle that is 10 to 24 inches thick. Menahga soils are sandy throughout. Also included are areas where the slope is more than 15 percent and areas where the substratum is sand, loamy sand, or sandy loam. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of the Mancelona soil and very rapid in the lower part. The available water capacity is low. Surface runoff is medium in cultivated areas. The droughtiness of the underlying sand and gravel generally hinders root growth. Organic matter content is low or moderately low in the surface layer.

Some areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is suited to irrigation. If irrigated, the soil can produce better and more consistent yields. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; wind stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are somewhat limited unless the soil is irrigated. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poorer survival rate unless the soil is irrigated. Topdressing with suitable fertilizer and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is only moderately suited to dwellings and to local roads and streets because of the slope. Cutting and filling can overcome this limitation. Dwellings can be designed so that they conform to the natural slope of the land. Constructing roads on the contour helps to overcome the slope.

The land capability classification is IIIe. The woodland ordination symbol is 3S.

MnB—Menahga sand, 0 to 6 percent slopes. This nearly level and gently sloping, deep, excessively drained soil is on flats and convex side slopes. Most areas are irregular in shape and range from about 10 to 1,300 acres in size.

Typically, the surface layer is black sand about 3 inches thick. The subsurface layer is very dark grayish brown sand about 2 inches thick. The subsoil is strong brown and dark yellowish brown, very friable and loose sand about 29 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose sand. In some places the surface layer is fine sand or loamy sand. In other places the upper part of the subsoil is loamy sand. In some areas the content of pebbles in the substratum is as much as 50 percent.

Included with this soil in mapping are small areas of Menominee, Rousseau, and Wainola soils. The well drained Menominee soils are in positions on the landscape similar to those of Menahga soil. They are underlain by loamy deposits at a depth of 20 to 40 inches. Rousseau and Wainola soils are dominantly fine sand throughout. The moderately well drained Rousseau soils are in the slightly lower areas, and the somewhat poorly drained Wainola soils are in drainageways and depressions. Also included are small areas where the slope is more than 6 percent, areas where the soil is severely eroded, and some areas where granite bedrock is at a depth of 40 to 60 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Menahga soil. The available water capacity is low. Surface runoff is slow in cultivated areas. Organic matter content is low in the surface layer.

Some areas are used for crops or pasture. Some are wooded. Some of the wooded areas have been planted to pine (fig. 5). This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. Crop yields generally are limited, however, by the low available water capacity. The soil is suited to sprinkler irrigation, which can result in better and more consistent yields. Because of the rapid permeability, the irrigation rate should be controlled. If the rate is excessive, plant nutrients can be leached from the root zone. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Applications of fertilizer are needed.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Yields generally are low unless fertilizer and irrigation water are applied. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poorer survival rate unless the soil is irrigated. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

Figure 5.—Planted red pine harvested for pulpwood on Menahga sand, 0 to 6 percent slopes.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. Windthrow can be minimized by area-selection or clearcut harvest methods. Loose sand can interfere with the traction of wheeled equipment.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is suited to dwellings and to local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 6S.

MnC—Menahga sand, 6 to 15 percent slopes. This sloping and moderately steep, deep, excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 10 to 700 acres in size.

Typically, the surface layer is very dark gray sand about 3 inches thick. The subsoil is brown, very friable sand about 18 inches thick. The substratum to a depth of about 60 inches is brown and yellowish brown, loose sand. In some places the surface layer is loamy sand or loamy fine sand. In other places the upper part of the subsoil is loamy sand. In some areas the content of pebbles in the substratum is as much as 50 percent.

Included with this soil in mapping are small areas of Cormant and Menominee soils. The poorly drained and very poorly drained Cormant soils are in depressions. The well drained Menominee soils are in positions on the landscape similar to those of the Menahga soil. They are underlain by loamy deposits at a depth of 20 to 40 inches. Also included are areas where the slope is less than 6 or more than 15 percent, areas where the soil is severely eroded, areas where the soil is stony, and some areas where granite bedrock is at a depth of 40 to 60 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Menahga soil. The available water capacity is low. Surface runoff is medium in cultivated areas. Organic matter content is low in the surface layer.

Some areas are used for crops or pasture. Some are wooded. Some of the wooded areas have been planted to pine. This soil is poorly suited to crops. During most years crop yields are limited by the low available water capacity. The soil is suited to sprinkler irrigation. If irrigated, it is suited to corn and small grain and to legumes and grasses for hay and pasture. Because of the rapid permeability, the irrigation rate should be controlled. If the rate is excessive, plant nutrients can be leached from the root zone. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Applications of fertilizer are needed.

A cover of pasture plants or hay is effective in controlling erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are low unless fertilizer and irrigation water are applied. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poorer survival rate unless the soil is irrigated. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. Windthrow can be minimized by area-selection or clearcut harvest methods. Loose sand can interfere with the traction of wheeled equipment.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is only moderately suited to dwellings and to local roads and streets because of the slope. Cutting and filling can overcome this limitation. Dwellings can be designed so that they conform to the natural slope of the land. Constructing roads on the contour helps to overcome the slope.

The land capability classification is IVs. The woodland ordination symbol is 6S.

MnD—Menahga sand, 15 to 35 percent slopes. This moderately steep to very steep, deep, excessively drained soil is on convex side slopes and ridgetops. Areas are irregular in shape and range from about 10 to 200 acres in size.

Typically, the surface layer is black sand about 4 inches thick. The subsoil is strong brown and yellowish brown, very friable sand about 23 inches thick. The substratum to a depth of about 60 inches is brownish yellow, loose sand. In some places the surface layer and the upper part of the subsoil are loamy sand. In other places the content of pebbles is more than 15 percent in the surface layer, subsoil, or substratum.

Included with this soil in mapping are small areas of the well drained Menominee soils. These soils are in positions on the landscape similar to those of the Menahga soil. They are underlain by loamy deposits at a depth of 20 to 40 inches. Also included are areas where the soil is sloping, areas where it is severely eroded, and areas where it is stony. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Menahga soil. The available water capacity is low. Surface runoff is rapid in cultivated areas. Organic matter content is low in the surface layer.

Most areas are wooded. Some of the wooded areas have been planted to pine. Some areas are pastured. Because of the low available water capacity, the hazard of soil blowing, and the severe hazard of erosion, this soil is generally unsuited to cultivated crops.

A cover of pasture plants or hay is effective in controlling erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are low because of the low available water capacity. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poorer survival rate. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Loose sand can interfere with the traction of wheeled equipment, especially during dry periods. Landings should be stabilized, so that they can withstand repeated use of heavy equipment. Where the slope prevents the use of planting machinery, hand planting is needed if natural regeneration is unreliable. The slope also can limit the use of harvesting machinery. Loss of planted or natural seedlings can be excessive during dry periods. It can be reduced by careful planting of vigorous nursery stock. Planting on the contour and carefully locating skid roads during harvest minimize erosion. Windthrow can be minimized by area-selection or clearcut harvesting methods.

This soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets because of the slope. Cutting and filling can overcome a slope of less than 20 percent. Dwellings can be designed so that they conform to the natural slope of the land. Septic tank absorption fields and local roads and streets can be constructed on the contour. A slope of more than 20 percent is difficult to overcome, and a more suitable site should be selected. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption

fields. The poor filtering capacity may result in the pollution of ground water.

The land capability classification is VIIs. The woodland ordination symbol is 6R.

MoB—Menominee loamy fine sand, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 350 acres in size.

Typically, the surface layer is dark brown loamy fine sand about 9 inches thick. The upper subsoil is strong brown, very friable fine sand about 8 inches thick. The next 6 inches is brown, very friable loamy fine sand. The lower subsoil is dark reddish brown, firm clay loam about 6 inches thick. The substratum to a depth of about 60 inches is brown, friable sandy loam. In some places the sandy mantle is less than 20 inches thick. In other places it is more than 40 inches thick. In some areas the soil is underlain by stratified silt and very fine sand. In other areas the surface layer is loamy sand or sand.

Included with this soil in mapping are small areas of Iosco, Menahga, Onaway, Shawano, and Tilleda soils. The somewhat poorly drained Iosco soils are in drainageways and depressions. Menahga, Onaway, Shawano, and Tilleda soils are in positions on the landscape similar to those of the Menominee soil. The excessively drained Menahga and Shawano soils are sandy throughout. The well drained and moderately well drained Onaway and well drained Tilleda soils are loamy throughout. Also included are areas where the slope is more than 6 percent, small areas where the depth to the water table is as shallow as 3 feet during wet periods, and areas where the substratum is silty clay loam, silty clay, or clay. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the upper part of the Menominee soil and moderate in the lower part. The available water capacity is moderate. Surface runoff is slow in cultivated areas. Organic matter content is low in the surface layer.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is suited to sprinkler irrigation. If irrigated, it can produce better and more consistent yields. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such a chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Applications of fertilizer are needed.

A cover of pasture plants or hay helps to control soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are somewhat limited unless the soil is irrigated. The best planting time is early in spring, before the surface layer dries out. Applications of fertilizer, pasture renovation, and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is suited to septic tank absorption fields and dwellings. If septic tank absorption fields are installed in the rapidly permeable sandy layers, the effluent can move laterally. This hazard can be overcome, however, by installing the absorption fields in the moderately permeable loamy layers. The soil is only moderately suited to local roads and streets because of a moderate potential for frost action. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

MoC—Menominee loamy fine sand, 6 to 12 percent slopes. This sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 100 acres in size.

Typically, the surface layer is dark brown loamy fine sand about 6 inches thick. The upper subsoil is about 16 inches of dark brown, very friable loamy fine sand and strong brown, very friable fine sand. The next 2 inches is brown, very friable loamy fine sand. The lower subsoil is reddish brown, friable loam about 6 inches thick. The substratum to a depth of about 60 inches is reddish brown, friable sandy loam. In some places the sandy mantle is less than 20 inches thick, and in other places it is more than 40 inches thick. In some areas the surface layer is sand, fine sand, or loamy sand.

Included with this soil in mapping are small areas of Menahga, Onaway, Shawano, and Tilleda soils. These soils are in positions on the landscape similar to those of Menominee soil. The excessively drained Menahga and Shawano soils are sandy throughout. The well drained Onaway and Tilleda soils are loamy throughout. Also included are small areas where the slope is less than 6 or more than 12 percent and areas where the substratum is silty clay loam, silty clay, or clay. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the upper part of the Menominee soil and moderate in the lower part. The available water capacity is moderate. Surface runoff is medium in cultivated areas. Organic matter content is low in the surface layer.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is suited to sprinkler irrigation. If irrigated, it can produce better and

more consistent yields. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Applications of fertilizer are needed.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are somewhat limited unless the soil is irrigated. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poorer survival rate unless the soil is irrigated. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is only moderately suited to septic tank absorption fields and dwellings because of the slope. Cutting and filling can overcome this limitation. If septic tank absorption fields are installed in the rapidly permeable sandy layers, the effluent can move laterally. This hazard can be overcome, however, by installing the absorption fields in the moderately permeable loamy layers.

Because of the slope and a moderate potential for frost action, this soil is only moderately suited to local roads and streets. Cutting and filling can overcome the slope. Constructing the roads on the contour also can overcome the slope. Covering or replacing the loamy part of the soil with suitable base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IVe. The woodland ordination symbol is 4S.

MoD—Menominee loamy fine sand, 12 to 20 percent slopes. This moderately steep, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 25 acres in size.

Typically, the surface layer is black loamy fine sand about 4 inches thick. The subsurface layer is pinkish gray, very friable loamy sand about 4 inches thick. The upper subsoil is strong brown, very friable loamy sand about 14 inches thick. The next 4 inches is reddish brown, friable loamy sand. The lower subsoil is reddish brown, firm clay loam about 9 inches thick. The substratum to a depth of about 60 inches is reddish brown, friable loam. In some areas the surface layer is loamy sand or sand. In some places the sandy mantle is less than 20 inches thick, and in other places it is more than 40 inches thick.

Included with this soil in mapping are small areas of Menahga, Onaway, Shawano, and Tilleda soils. These soils are in positions on the landscape similar to those of Menominee soil. The excessively drained Menahga and Shawano soils are sandy throughout. The well drained Onaway and Tilleda soils are loamy throughout. Also included are small areas where the slope is less than 12 or more than 20 percent and areas where the soil is severely eroded. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the upper part of the Menominee soil and moderate in the lower part. The available water capacity is moderate. Surface runoff is rapid in cultivated areas. Organic matter content is low in the surface layer.

Most areas are used as pasture or woodland. Some are used for crops. This soil generally is unsuited to cultivated crops. It is suited to legumes and grasses for hay and pasture.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poorer survival rate. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets because of the slope. Cutting and filling can overcome this limitation. If septic tank absorption fields are installed in the rapidly permeable sandy layers, the effluent can move laterally. This hazard can be overcome, however, by installing the absorption fields in the moderately permeable loamy layers.

The land capability classification is VIe. The woodland ordination symbol is 4S.

Mu—Minocqua mucky fine sandy loam, 0 to 2 percent slopes. This nearly level, deep, poorly drained and very poorly drained soil is in depressions, in drainageways, and on low lying flats. It is subject to ponding. Most areas are long and narrow and range from about 5 to 30 acres in size.

Typically, the surface layer is black muck about 4 inches thick. The subsurface layer is dark gray, friable fine sandy loam about 6 inches thick. The subsoil is light gray and gray, friable fine sandy loam about 26 inches thick. The substratum to a depth of about 60 inches is

grayish brown, loose sand. In some places the surface layer is loamy sand or sandy loam. In other places it is muck as much as 8 inches thick. In some areas the soil has a silty mantle as much as 20 inches thick. In other areas the substratum has loamy or gravelly strata.

Included with this soil in mapping are small areas of Cormant, Rousseau, and Worcester soils. Cormant and Rousseau soils are sandy throughout. The poorly drained and very poorly drained Cormant soils are in positions on the landscape similar to those of the Minocqua soil. The moderately well drained Rousseau soils are in the higher landscape positions. The somewhat poorly drained Worcester soils are slightly higher on the landscape than the Minocqua soil. Also included are areas where the soil is very stony. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Minocqua soil and rapid or very rapid in the lower part. The available water capacity is moderate. Surface runoff is very slow or ponded. The seasonal high water table is above or near the surface most of the year. Root growth is hindered by the water table in undrained areas. In drained areas it is hindered by droughtiness if the sandy substratum dries out. Organic matter content is high or very high in the surface layer.

Most areas are undrained and are wooded. They are unsuited to crops. They provide wildlife habitat. Some are used as unimproved pasture. A few small areas have been drained. They are used for corn or small grain or for legumes and grasses for hay and pasture.

Because of the high water table and the periodic ponding, undrained areas are unsuitable for most forage species. They can be used only for such species as reed canarygrass and Garrison creeping foxtail. Drained areas are suited to certain legumes and grasses. Overgrazing reduces the extent of the protective plant cover and encourages the growth of undesirable plant species. Grazing when the surface layer is wet results in surface compaction and poor tilth and reduces the rate of water infiltration. Applications of fertilizer, pasture renovation, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. Access is limited to dry summer months or winter months that have an adequate snow cover. If year-round roads are constructed, fill, a gravel base, and culverts are needed to reduce the wetness. Because of the high water table, trees tend to be shallow rooted and many are blown down during high winds. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is generally unsuited to septic tank absorption fields because of the ponding and the rapid permeability in the substratum and to dwellings because of the ponding. Overcoming these limitations is difficult, and a more suitable site should be selected. The soil is poorly suited to local roads because of the ponding and a high potential for frost action. Ponding can be overcome by using fill material to elevate the roadway and by providing bridges or culverts that are larger than is typical. The damage caused by frost action can be minimized by installing a subsurface drainage system in the roadbed and by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is VIw. The woodland ordination symbol is 7W.

NeB—Nester silt loam, 1 to 6 percent slopes. This nearly level and gently sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 5 to 60 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil is dominantly reddish brown, very firm clay about 15 inches thick. The substratum to a depth of about 60 inches is reddish brown, very firm silty clay loam. In some places the surface layer is sandy loam, fine sandy loam, or loam. In other places the soil is underlain by stratified silt and very fine sand.

Included with this soil in mapping are small areas of Menominee and Shiocton soils. The well drained Menominee soils are in positions on the landscape similar to those of the Nester soil. They have a sandy mantle that is 20 to 40 inches thick. The somewhat poorly drained Shiocton soils are in drainageways and depressions. They formed in loamy deposits. Also included are small areas of soils that have less clay in the subsoil and substratum than the Nester soil, areas where the slope is more than 6 percent, and areas where the soil is severely eroded. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Nester soil. The available water capacity is high. Surface runoff is medium in cultivated areas. Organic matter content is moderately low or moderate in the surface layer. This layer is firm and tends to crust after heavy rains.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If the soil is cultivated, erosion is a moderate or severe hazard. It is especially damaging because it exposes the clay subsoil. It can be controlled by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; contour stripcropping; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth.

A cover of pasture plants or hay helps to control erosion. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Grazing when the surface layer

is wet results in surface compaction and poor tilth and increases the rate of runoff and the hazard of erosion. Topdressing with suitable fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields because of the moderately slow permeability. Mounding with suitable filtering material and enlarging the absorption field helps to overcome this limitation. The soil is only moderately suited to dwellings because of the shrink-swell potential. Replacing the soil under the footings or concrete slab with coarse textured material, such as sand or gravel, helps to overcome this limitation.

Because of low strength, this soil is poorly suited to local roads and streets. The low strength can be overcome by replacing the upper part of the soil with coarse textured base material, such as sand or gravel. It also can be overcome by increasing the thickness of the pavement or the base material.

The land capability classification is IIe. The woodland ordination symbol is 3A.

OcB—Oconto fine sandy loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 6 to 120 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The next 7 inches is dark brown and brown, very friable fine sandy loam. The subsoil is dominantly reddish brown, friable sandy loam about 17 inches thick. The substratum to a depth of about 60 inches is strong brown, loose sand. In some places the surface layer is loam or sandy loam. In other places the depth to sand or to sand and gravel is more than 40 inches. In some areas the soil is underlain by stratified sand and gravel.

Included with this soil in mapping are small areas of Kiva and Worcester soils. The well drained Kiva soils are in positions on the landscape similar to those of the Oconto soil. They have sand and gravel within a depth of 24 inches. The somewhat poorly drained Worcester soils are in the lower positions on the landscape. Also included are areas of soils that have more clay and less sand and silt in the subsoil than the Oconto soil or are underlain by loamy till below a depth of 40 inches and some areas where the depth to the water table is as shallow as 3 feet during wet periods. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the upper part of the Oconto soil and rapid or very rapid in the lower part. The available water capacity is low. Surface runoff is slow or medium in cultivated areas. The droughtiness of the underlying sand and gravel commonly hinders root growth. Organic matter content is moderately low in the surface layer. This layer is friable and can be easily tilled.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. During most years, however, crop yields are limited by the low available water capacity. The soil is suited to sprinkler irrigation. If irrigated, it can produce better and more consistent yields. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are somewhat limited unless the soil is irrigated. Topdressing with suitable fertilizer and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is suited to dwellings. It is only moderately suited to local roads and streets because of a moderate potential for frost action. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 3A.

OcC—Oconto fine sandy loam, 6 to 12 percent slopes. This sloping, deep, well drained soil is on convex ridgetops and side slopes. Most areas are irregular in shape and range from about 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 4 inches thick. The upper subsoil is dark brown, very friable fine sandy loam about 8 inches thick. The next 10 inches is brown, very friable fine sandy loam and mixed brown and reddish brown, very friable and friable sandy loam. The lower subsoil is reddish brown, friable sandy loam about 16 inches thick. The substratum to a depth of about 60 inches is pale

brown, loose, stratified sand and gravel. In places the surface layer is loam, sandy loam, or loamy sand.

Included with this soil in mapping are small areas of the well drained Kiva soils. These soils are in positions on the landscape similar to those of the Oconto soil. They have sand and gravel within a depth of 24 inches. Also included are areas where the slope is less than 12 percent, areas of soils that have more clay and less silt and sand in the subsoil than the Oconto soil, and small areas where the soil is eroded. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Oconto soil and rapid or very rapid in the lower part. The available water capacity is low. Surface runoff is medium in cultivated areas. The droughtiness of the underlying sand and gravel commonly hinders root growth. Organic matter content is moderately low in the surface layer. This layer is friable and can be easily tilled.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. During most years crop yields are limited, however, by the low available water capacity. If irrigated and intensively managed, the soil can produce better and more consistent yields. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Topdressing with suitable fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is only moderately suited to dwellings because of the slope. Cutting and filling can overcome this limitation. Also, the dwellings can be designed so that they conform to the natural slope of the land.

Because of the slope and a moderate potential for frost action, this soil is only moderately suited to local roads and streets. Cutting and filling help to overcome the slope. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

OcD—Oconto fine sandy loam, 12 to 20 percent slopes. This moderately steep, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 5 to 80 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsoil is about 17 inches thick. The upper part is brown, friable sandy loam, and the lower part is reddish brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, loose, stratified sand and gravel. In places the surface layer is loamy sand or sandy loam.

Included with this soil in mapping are small areas of the excessively drained Alpena and well drained Kiva soils. These soils are in positions on the landscape similar to those of the Oconto soil. Their loamy mantle is thinner than that of the Oconto soil. Also included are areas where the slope is less than 12 or more than 20 percent and areas of soils that have more clay and less silt and sand in the subsoil than the Oconto soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Oconto soil and rapid or very rapid in the lower part. The available water capacity is low. Surface runoff is rapid. Organic matter content is moderately low in the surface layer. This layer is friable and can be easily tilled.

Some areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. During most years crop yields are limited, however, by the low available water capacity. If the soil is cultivated, erosion is a severe hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Topdressing with suitable fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. Planting on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. The vegetation that competes with planted seedlings or natural regeneration following harvest can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields because it does not adequately filter the effluent and is too steep. The poor filtering capacity can result in the pollution of ground water. The soil is poorly suited to dwellings and to local roads and streets because of the slope. Cutting and filling help to overcome the slope. Local roads and streets should be constructed on the contour.

The land capability classification is IVe. The woodland ordination symbol is 3A.

OeB—Onaway fine sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 5 to 500 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown, very friable fine sandy loam about 6 inches thick. The next 4 inches is mixed reddish brown, friable loam and brown, very friable fine sandy loam. The subsoil is reddish brown, friable loam about 7 inches thick. The substratum to a depth of about 60 inches is brown, friable sandy loam. In some places the surface layer is sandy loam, loam, or silt loam. In other places the soil is eroded. In some areas sand and gravel are below a depth of 40 inches. In other areas the substratum is stratified silt and very fine sand. In places the depth to free carbonates is more than 30 inches.

Included with this soil in mapping are small areas of Fairport, Menominee, and Solona soils. The well drained Fairport and Menominee soils are in positions on the landscape similar to those of the Onaway soil. Fairport soils have dolomite bedrock at a depth of 20 to 40 inches. Menominee soils have a sandy mantle that is 20 to 40 inches thick. The somewhat poorly drained Solona soils are in depressions and drainageways. Also included are areas where the slope is more than 6 percent, areas where the soil is severely eroded, small areas where the depth to the water table is as shallow as 3 feet, small areas where dolomite bedrock is at a depth of 40 to 60 inches, and areas of soils that contain less clay in the subsoil than the Onaway soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Onaway soil. The available water capacity is high. Surface runoff is slow or medium in cultivated areas. Organic matter content is moderately low or moderate in the surface layer. This layer is friable and can be easily tilled.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Grazing when the surface layer is wet results in surface compaction and poor tilth and increases the runoff rate and the hazard of erosion. Applications of fertilizer, pasture renovation, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil is only moderately suited to septic tank absorption fields because of the moderate permeability. Mounding with suitable filtering material or enlarging the absorption field helps to overcome this limitation. The soil is suited to dwellings. It is only moderately suited to local roads and streets because of a moderate potential for frost action. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 3A.

OeC2—Onaway fine sandy loam, 6 to 12 percent slopes, eroded. This sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 150 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. In most cultivated areas plowing has mixed some dark reddish brown, loamy subsoil material into the surface layer. The subsoil is dark reddish brown, friable loam about 14 inches thick. The substratum to a depth of about 60 inches is reddish brown, friable loam. In some places the soil is uneroded. In other places the surface layer is sandy loam or silt loam. In some areas the depth to free carbonates is more than 30 inches. In other areas the soil is underlain by sand and gravel at a depth of about 40 inches. In places the substratum is stratified silt and fine sand.

Included with this soil in mapping are small areas of the well drained Fairport, Kiva, and Menominee soils. These soils are in positions on the landscape similar to those of the Onaway soil. Fairport soils have dolomite bedrock at a depth of 20 to 40 inches. Kiva soils have less clay in the subsoil than the Onaway soil and are underlain by gravelly and very gravelly sand at a depth of 10 to 24 inches. Menominee soils have a sandy mantle that is 20 to 40 inches thick. Also included are areas where the slope is less than 6 or more than 12

percent, areas where the soil is severely eroded, some areas of soils that have less clay in the subsoil or more clay in the substratum than the Onaway soil, and some areas where dolomite bedrock is at a depth of 40 to 60 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Onaway soil. The available water capacity is high. Surface runoff is medium in cultivated areas. Organic matter content is moderately low or moderate in the surface layer. In eroded areas the surface layer is difficult to till because it is mixed with loamy subsoil material. Also, it tends to crust after heavy rains.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If the soil is cultivated, further erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Grazing when the surface layer is wet results in surface compaction and poor tilth and increases the runoff rate and the hazard of erosion. Topdressing with suitable fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil is only moderately suited to septic tank absorption fields because of the moderate permeability and the slope. Mounding with suitable filtering material or enlarging the absorption field helps to overcome the moderate permeability. Cutting and filling or installing a trench absorption system on the contour helps to overcome the slope. The soil is only moderately suited to dwellings because of the slope. Cutting and filling can overcome this limitation.

Because of the slope and a moderate potential for frost action, this soil is only moderately suited to local roads and streets. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action. Cutting and filling or constructing the roads on the contour helps to overcome the slope.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

OeD2—Onaway fine sandy loam, 12 to 20 percent slopes, eroded. This moderately steep, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 80 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. In most cultivated areas plowing has mixed some brown sandy loam from the subsoil into the surface layer. The subsoil is about 19 inches thick. The upper part is brown, friable sandy loam, and the lower part is yellowish red, friable loam. The substratum to a depth of about 60 inches is reddish brown, friable loam. In some places the surface layer is loam, loamy fine sand, or sandy loam. In other places the depth to free carbonates is more than 30 inches. In some areas the soil is underlain by stratified sand and gravel below a depth of 40 inches. In other areas the soil is not eroded. The uneroded areas generally are wooded.

Included with this soil in mapping are small areas of the well drained Kiva and Menominee and excessively drained Shawano soils. These soils are in positions on the landscape similar to those of the Onaway soil. Kiva soils have less clay in the subsoil than the Onaway soil and are underlain by stratified gravelly and very gravelly sand at a depth of 10 to 24 inches. Menominee soils have a sandy mantle that is 20 to 40 inches thick. Shawano soils are sandy throughout. Also included are areas where the slope is less than 12 or more than 20 percent, areas where the soil is severely eroded, small areas of soils that have less clay in the subsoil than the Onaway soil, and small areas where dolomite bedrock is at a depth of 40 to 60 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Onaway soil. The available water capacity is high. Surface runoff is rapid in cultivated areas. Organic matter content is moderately low or moderate in the surface layer. This layer is friable and can be easily tilled.

Some areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. If the soil is cultivated, erosion is a severe hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Grazing when the surface layer is wet results in surface compaction and poor tilth and increases the runoff rate and the hazard of

erosion. Applications of fertilizer, pasture renovation, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. Planting on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. The seedling mortality rate on south- and west-facing slopes can be reduced by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets because of the slope. This limitation can be overcome by cutting and filling, by installing a trench absorption system on the contour, and by constructing local roads and streets on the contour.

The land capability classification is IVe. The woodland ordination symbol is 3R.

OeE—Onaway fine sandy loam, 20 to 35 percent slopes. This steep and very steep, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 5 to 60 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 4 inches thick. The upper subsoil is brown, friable fine sandy loam about 8 inches thick. The next 4 inches is mixed dark reddish brown and pinkish gray, friable loam. The lower subsoil is dark reddish brown, firm clay loam about 5 inches thick. The substratum to a depth of about 60 inches is brown, friable sandy loam. In some places the surface layer is loam, sandy loam, or loamy fine sand. In other places the soil is underlain by stratified sand and gravel below a depth of 40 inches.

Included with this soil in mapping are small areas of the well drained Kiva and Menominee and excessively drained Shawano soils. These soils are in positions on the landscape similar to those of the Onaway soil. Kiva soils have less clay in the subsoil than the Onaway soil and are underlain by stratified gravelly and very gravelly sand at a depth of 10 to 24 inches. Menominee soils have a sandy mantle that is 20 to 40 inches thick. Shawano soils are sandy throughout. Also included are small areas where the slope is less than 20 percent, areas where the soil is severely eroded, and small areas of soils that have less clay in the subsoil than the Onaway soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Onaway soil. The available water capacity is high. Surface runoff is very rapid. Organic matter content is moderately low or moderate in the surface layer.

Most areas are wooded. Some are used for crops or pasture. Because of a very severe hazard of erosion and the hazard of soil blowing, this soil generally is unsuitable for cultivated crops. It is suited to pasture and hay. A cover of pasture plants or hay helps to prevent excessive soil loss. Overgrazing reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Planting on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. The seedling mortality rate on south- and west-facing slopes can be reduced by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is generally unsuited to septic tank absorption fields and dwellings because of the slope. This limitation is difficult to overcome, and a more suitable site should be selected. The soil is poorly suited to local roads and streets because of the slope. Cutting and filling or constructing the roads on the contour helps to overcome this limitation.

The land capability classification is VIe. The woodland ordination symbol is 3R.

OmB—Onaway fine sandy loam, moderately well drained, 1 to 6 percent slopes. This nearly level and gently sloping, deep, moderately well drained soil is on concave side slopes and flats. Most areas are irregular in shape and range from about 5 to 300 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 10 inches thick. The upper subsoil is brown, friable sandy loam about 6 inches thick. The next 5 inches is mixed reddish brown, firm clay loam and brown, friable sandy loam. The lower subsoil is about 10 inches of reddish brown, firm clay loam and brown, friable sandy loam. The substratum to a depth of about 60 inches is brown, mottled, friable sandy loam. In some places the surface layer is sandy loam, loam, or silt loam. In other places the substratum is silty clay loam or stratified silt and fine sand. In some areas sand and gravel are at a depth of about 40 inches.

Included with this soil in mapping are small areas of Fairport, Menominee, and Solona soils. The well drained Fairport and Menominee soils are in the slightly higher areas. Fairport soils have dolomite bedrock at a depth of 20 to 40 inches. Menominee soils have a sandy mantle that is 20 to 40 inches thick. The somewhat poorly drained Solona soils are in depressions and drainageways. Also included are small areas of well drained Onaway soils and small areas of soils that have less clay in the subsoil than the Onaway soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Onaway soil. The available water capacity is high. Surface runoff is slow or medium in cultivated areas. The seasonal high water table is at a depth of 3 to 6 feet during wet periods. Organic matter content is moderately low or

moderate in the surface layer. This layer is friable and can be easily tilled.

Many areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Grazing when the surface layer is wet results in surface compaction and poor tilth and increases the runoff rate and the hazard of erosion. Applications of fertilizer, pasture renovation, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and the moderately slow permeability in the subsoil. Mounding with suitable filtering material helps to overcome these limitations. The soil is suited to dwellings without basements. It is only moderately suited to dwellings with basements because of the seasonal high water table. This limitation can be overcome by installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, or by constructing the basement above the level of wetness.

Because of a moderate potential for frost action, this soil is only moderately suited to local roads and streets. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 3A.

OsB—Onaway fine sandy loam, sandy substratum, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 4 to 180 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 10 inches thick. The upper subsoil is brown, friable fine sandy loam about 6 inches thick. The next 7 inches is mixed yellowish red, firm loam and brown, friable fine sandy loam. The lower subsoil is reddish brown, firm loam about 19 inches thick. Below this is yellowish red, friable loamy fine sand about 4 inches thick. The substratum to a depth of about 60 inches is light yellowish brown, loose fine sand. In some places the substratum is stratified sand and gravel. In other places the loamy mantle is less than 40 inches thick.

Included with this soil in mapping are small areas of Menominee and Solona soils. The well drained Menominee soils are in positions on the landscape similar to those of the Onaway soil. They have a sandy mantle that is 20 to 40 inches thick. The somewhat poorly drained Solona soils are in the lower areas. They are loamy throughout. Also included are some areas where the depth to the water table is as shallow as 3 feet during wet periods and some areas of soils that have less clay and more silt and sand in the subsoil than the Onaway soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Onaway soil and rapid in the lower part. The available water capacity is moderate. Surface runoff is slow or medium in cultivated areas. The droughtiness of the underlying sand hinders root growth. Organic matter content is moderately low or moderate in the surface layer. This layer is friable and can be easily tilled.

Most areas are used for crops or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. It is suited to sprinkler irrigation. If the soil is irrigated, yields are generally better and more consistent. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are somewhat limited in dry years unless the soil is irrigated. Topdressing with suitable fertilizer and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil is moderately suited to septic tank absorption fields because of the moderate permeability in the subsoil. Mounding with suitable filtering material helps to overcome this limitation. If the absorption field is installed in the sandy substratum, pollution of the ground

water is a hazard. The soil is only moderately suited to dwellings because of the shrink-swell potential. Replacing the soil under the footings or concrete slab with coarse textured material, such as sand or gravel, helps to overcome this limitation.

Because of low strength and a moderate potential for frost action, this soil is only moderately suited to local roads and streets. These limitations can be overcome by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 3A.

OvC—Onaway-Kiva-Menahga complex, 4 to 15 percent slopes. These gently sloping to moderately steep, deep soils are on convex side slopes. The Onaway and Kiva soils are well drained, and the Menahga soil is excessively drained. Areas generally are irregular in shape and range from about 5 to 120 acres in size. They are 30 to 40 percent Onaway soil, 25 to 35 percent Kiva soil, and 15 to 30 percent Menahga soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Onaway soil has a surface layer of dark brown fine sandy loam about 9 inches thick. The subsoil is dark reddish brown, friable clay loam about 14 inches thick. The substratum to a depth of about 60 inches is reddish brown, friable loam. In some places the surface layer is loam, sandy loam, or silt loam. In other places the loamy mantle is less than 40 inches deep over sand and gravel. In some areas the soil is underlain by stratified silt and very fine sand.

Typically, the Kiva soil has a surface layer of very dark brown sandy loam about 7 inches thick. The subsoil is brown and dark reddish brown, friable sandy loam about 15 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, loose very gravelly sand. In some places the surface layer is fine sandy loam, loam, or loamy sand. In other places the loamy mantle is more than 24 inches thick.

Typically, the Menahga soil has a surface layer of very dark gray sand about 3 inches thick. The subsoil is brown, very friable sand about 18 inches thick. The substratum to a depth of about 60 inches is brown and yellowish brown, loose sand. In some places the surface layer is loamy sand or loamy fine sand. In other places the upper part of the subsoil is loamy sand. In some areas the content of pebbles is as much as 50 percent in the substratum. In other areas strata of loam or sandy loam are in the lower part of the subsoil.

Included with these soils in mapping are small areas of the well drained Menominee soils. These included soils are in landscape positions similar to those of the Onaway, Kiva, and Menahga soils. They have a sandy mantle that is 20 to 40 inches deep over loamy deposits. Also included are areas where the slope is more than 15 percent. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Onaway soil and rapid in the Menahga soil. It is moderate in the upper part of the Kiva soil and very rapid in the lower part. The available water capacity is high in the Onaway soil and low in the Kiva and Menahga soils. Surface runoff is medium in cultivated areas of all three soils. The droughtiness of the underlying sand and gravel in the Kiva and Menahga soils hinders root growth. Organic matter content is moderately low or moderate in the surface layer of the Onaway soil, low or moderately low in that of the Kiva soil, and low in that of the Menahga soil. The surface layer of all three soils is friable or very friable and can be easily tilled.

Most areas are used for crops or pasture (fig. 6). These soils are suited to corn and small grain and to grasses and legumes for hay and pasture. Crop yields on the Kiva and Menahga soils are limited, however, by the low available water capacity. If the soils are cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing and encourages the growth of undesirable plant species. Forage yields generally are limited by the low available water capacity of the Kiva and Menahga soils. Grazing when the surface layer of the Onaway soil is wet results in surface compaction and poor tilth and reduces the rate of water infiltration. Topdressing with suitable fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

These soils are suited to trees. Competing vegetation interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal. Seedling survival on the Menahga soil can be improved by careful planting of vigorous nursery stock. Loose sand can interfere with the traction of wheeled equipment.

The Onaway soil is only moderately suited to septic tank absorption fields because of the moderate permeability and the slope. Mounding with suitable filtering material or enlarging the absorption field helps to overcome the moderate permeability. Cutting and filling or installing a trench absorption system on the contour helps to overcome the slope. The Kiva and Menahga soils readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The

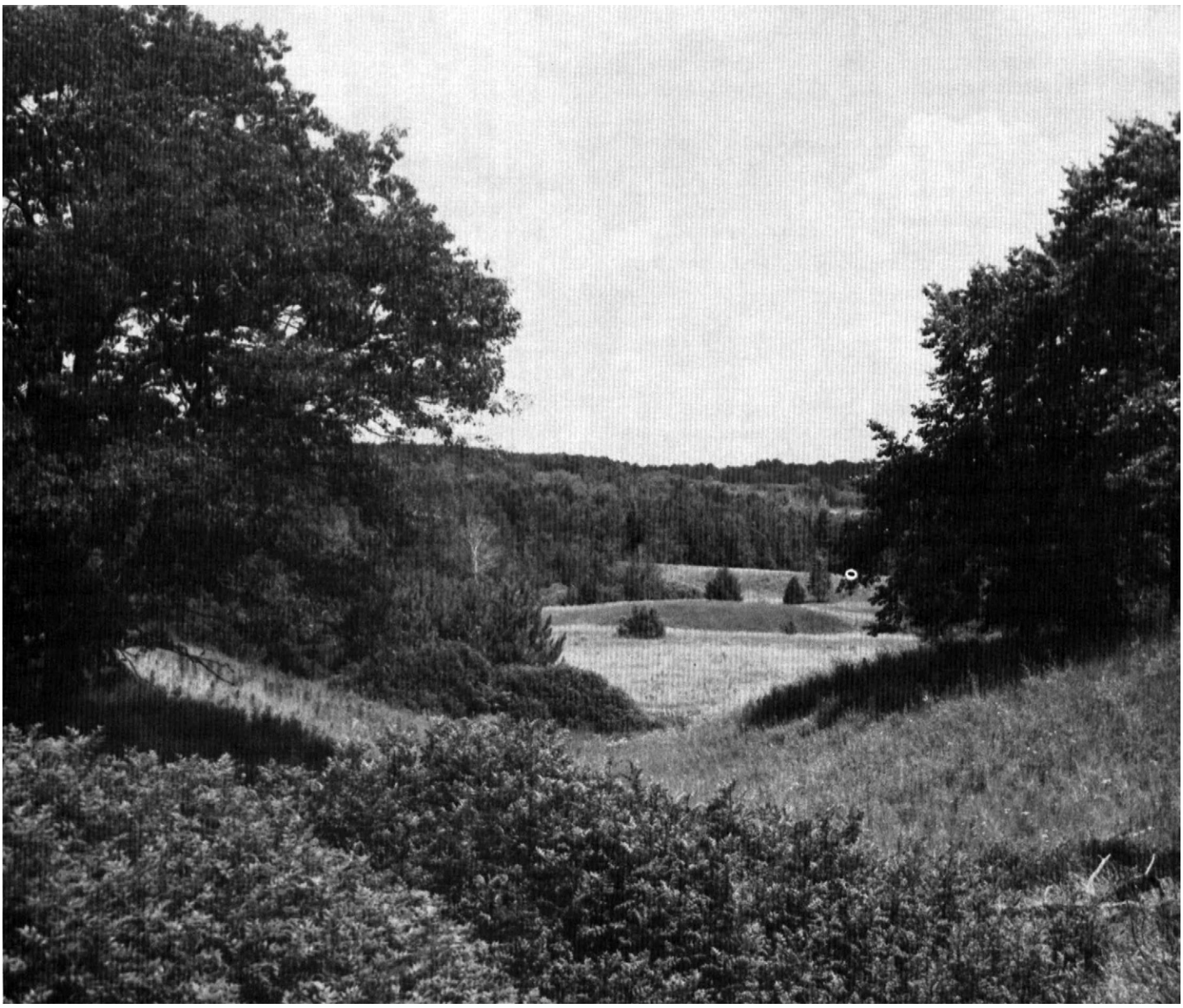

Figure 6.—An area of Onaway-Kiva-Menahga complex, 4 to 15 percent slopes, used for pasture.

Onaway, Kiva, and Menahga soils are only moderately suited to dwellings because of the slope. Cutting and filling can overcome this limitation.

These soils are only moderately suited to local roads and streets because of the slope of all three soils and a moderate potential for frost action in the Onaway soil. Cutting and filling or constructing the roads on the contour helps to overcome the slope. Covering or replacing the upper part of the Onaway soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IVe. The woodland ordination symbol is 3A for the Onaway and Kiva soils and 6S for the Menahga soil.

OvD—Onaway-Kiva-Menahga complex, 15 to 35 percent slopes. These moderately steep to very steep, deep soils are on convex side slopes. The Onaway and Kiva soils are well drained, and the Menahga soil is

excessively drained. Areas generally are irregular in shape and range from about 10 to 70 acres in size. They are 30 to 40 percent Onaway soil, 20 to 40 percent Kiva soil, and 15 to 30 percent Menahga soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Onaway soil has a surface layer of very dark grayish brown fine sandy loam about 4 inches thick. The upper subsoil is brown, friable fine sandy loam about 8 inches thick. The next 4 inches is mixed dark reddish brown and pinkish gray, friable loam. The lower subsoil is dark reddish brown, firm clay loam about 5 inches thick. The substratum to a depth of about 60 inches is brown, friable loam. In some places the surface layer is sandy loam or loam. In other places the loamy mantle is less than 40 inches deep over sand and gravel.

Typically, the Kiva soil has a surface layer of very dark brown sandy loam about 3 inches thick. The subsoil is about 13 inches thick. It is brown, friable sandy loam in the upper part and dark brown, friable gravelly sandy loam in the lower part. The substratum to a depth of about 60 inches is strong brown, loose, stratified coarse sand and very gravelly sand. In some places the surface layer is loam, fine sandy loam, or loamy sand. In other places the loamy mantle is more than 24 inches thick.

Typically, the Menahga soil has a surface layer of black sand about 4 inches thick. The subsoil is strong brown and yellowish brown, very friable sand about 23 inches thick. The substratum to a depth of about 60 inches is brownish yellow, loose sand. In some places the surface layer or the upper part of the subsoil is loamy sand. In other places the content of gravel is more than 15 percent in the surface layer, subsoil, or substratum. In some areas strata of sandy loam or loam are in the lower part of the subsoil.

Included with these soils in mapping are small areas of the well drained Menominee soils. These included soils are in landscape positions similar to those of the Onaway, Kiva, and Menahga soils. They have a sandy mantle that is 20 to 40 inches deep over loamy deposits. Also included are small areas where the slope is less than 15 percent and small areas where the soil is severely eroded. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Onaway soil and rapid in the Menahga soil. It is moderate in the upper part of the Kiva soil and very rapid in the lower part. The available water capacity is high in the Onaway soil and low in the Kiva and Menahga soils. Surface runoff is rapid or very rapid on all three soils. The droughtiness of the underlying sand and gravel in the Kiva and Menahga soils generally hinders root growth. Organic matter content is moderately low or moderate in the surface layer of the Onaway soil, low or moderately low in that of the Kiva soil, and low in that of the Menahga soil.

Most areas are wooded. Some are used as pasture or hayland. These soils are generally unsuited to cultivated crops because of a severe or very severe hazard of erosion, the hazard of soil blowing, and the low available water capacity of the Kiva and Menahga soils. The soils are suited to pasture and hay. Forage yields on the Kiva and Menahga soils generally are limited, however, by the low available water capacity. Overgrazing reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

These soils are suited to trees. Planting on the contour and carefully locating skid roads during harvest minimize erosion. Seedling survival on the steeper slopes facing south or west can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal. The slope limits the use of equipment. Skidding can expose enough mineral soil to permit adequate regeneration.

These soils are poorly suited to septic tank absorption fields, dwellings, and local roads and streets because of the slope. Cutting and filling can overcome a slope of less than 20 percent. Dwellings can be designed so that they conform to the natural slope of the land. Septic tank absorption fields and local roads and streets can be constructed on the contour. A slope of more than 20 percent is difficult to overcome, and a more suitable site should be selected. In the Kiva and Menahga soils, septic tank effluent drains satisfactorily, but it can pollute ground water.

The land capability classification is VIIe. The woodland ordination symbol is 3R for the Onaway and Kiva soils and 6R for the Menahga soil.

PaB—Padus fine sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping, deep, well drained soil is on flats and convex side slopes. Most areas are irregular in shape and range from about 10 to 200 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 3 inches thick. The upper subsoil is brown, friable fine sandy loam about 8 inches thick. The next 6 inches is mixed reddish brown, friable loam and brown, friable fine sandy loam. The lower subsoil is about 14 inches of reddish brown, friable loam and dark reddish brown, very friable gravelly loamy sand. The upper part of the substratum is strong brown, loose sand. The lower part to a depth of about 60 inches is dark brown, loose gravelly coarse sand. In some places the surface layer is silt loam, loam, or sandy loam. In other places the soil has a silty mantle as much as 36 inches thick. In some areas the loamy mantle is more than 40 inches thick.

Included with this soil in mapping are small areas of Kennan, Pence, and Worcester soils. The well drained Kennan and Pence soils are in positions on the

landscape similar to those of the Padus soil. Kennan soils are underlain by sandy loam or loamy sand. Pence soils have a loamy mantle that is 12 to 24 inches thick. The somewhat poorly drained Worcester soils are in depressions and drainageways. Also included are small areas where the slope is more than 6 percent, areas where the soil is very stony, and some small areas where the depth to the water table is as shallow as 3 feet during wet periods. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Padus soil and rapid or very rapid in the lower part. The available water capacity is moderate. Surface runoff is slow or medium. The droughtiness of the underlying sand and gravel generally hinders root growth. Organic matter content is moderately low in the surface layer. This layer is friable and can be easily tilled.

Most areas are wooded. Some are used for crops or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Topdressing with suitable fertilizer and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is suited to dwellings. It is only moderately suited to local roads and streets because of a moderate potential for frost action. Covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 3a.

PaC—Padus fine sandy loam, 6 to 15 percent slopes. This sloping and moderately steep, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 10 to 180 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 4 inches thick. The subsurface layer is dark grayish brown, friable fine sandy loam about 5 inches thick. The upper subsoil is brown, friable fine sandy loam about 4 inches thick. The next 12 inches is brown, friable fine sandy loam and mixed brown, friable loam and fine sandy loam. The lower subsoil is brown, friable and very friable loamy sand about 13 inches thick. The substratum to a depth of about 60 inches is brown, loose, stratified coarse sand and gravel. In some places the surface layer is silt loam or loam. In other places the soil has a silty mantle as much as 36 inches thick. In some areas the loamy mantle is more than 40 inches thick.

Included with this soil in mapping are small areas of the well drained Kennan and Pence soils. These soils are in positions on the landscape similar to those of the Padus soil. Kennan soils are underlain by sandy loam or loamy sand. Pence soils have a loamy mantle that is 12 to 24 inches thick. Also included are areas where the slope is less than 6 or more than 15 percent and areas where the soil is very stony. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Padus soil and rapid or very rapid in the lower part. The available water capacity is moderate. Surface runoff is medium. The droughtiness of the underlying sand and gravel generally hinders root growth. Organic matter content is moderately low or low in the surface layer. This layer is friable and can be easily tilled.

Most areas are wooded. Some are used for crops or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay and pasture. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Topdressing with suitable fertilizer and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is only moderately suited to dwellings

because of the slope. Cutting and filling can overcome this limitation. Also, the dwellings can be designed so that they conform to the natural slope of the land.

Because of the slope and a moderate potential for frost action, this soil is only moderately suited to local roads and streets. Cutting and filling help to overcome the slope. Replacing the upper part of the soil with coarse textured base material, such as sand or gravel, helps to prevent the damage caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3a.

PaD—Padus fine sandy loam, 15 to 35 percent slopes. This moderately steep to very steep, deep, well drained soil is on convex ridgetops and side slopes. Most areas are irregular in shape and range from about 10 to 200 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 2 inches thick. The subsurface layer is dark grayish brown, very friable sandy loam about 2 inches thick. The upper subsoil is strong brown, very friable sandy loam about 10 inches thick. The next 4 inches is mixed reddish brown and brown, friable sandy loam. The lower subsoil is about 11 inches of reddish brown, friable sandy loam and brown, very friable loamy sand. The substratum to a depth of about 60 inches is dark brown and brown, loose sand. In some places the surface layer is silt loam, loam, sandy loam, or loamy sand. In other places the loamy mantle is more than 40 inches thick.

Included with this soil in mapping are small areas of the well drained Kennan and Pence soils. These soils are in positions on the landscape similar to those of the Padus soil. Kennan soils are underlain by sandy loam or loamy sand. Pence soils have a loamy mantle that is 12 to 24 inches thick. Also included are small areas where the slope is less than 15 percent and areas where the soil is very stony. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Padus soil and rapid or very rapid in the lower part. The available water capacity is moderate. Surface runoff is very rapid. The droughtiness of the underlying sand and gravel generally hinders root growth. Organic matter content is moderately low in the surface layer. This layer is friable and can be easily tilled.

This soil generally is unsuited to cultivated crops because of a very severe hazard of erosion. It is suited to grasses and legumes for hay and pasture. A cover of pasture plants or hay helps to prevent excessive soil loss. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion.

Most areas are wooded. This soil is suited to trees. Erosion is a hazard because runoff concentrates on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water by out-sloping road surfaces, culverts, and drop structures minimizes erosion. Building roads on the contour or on the gentler slopes also helps to control erosion. Seeding roads, trails, and landings after logging helps to establish a protective vegetative cover. The use of equipment is restricted because of the slope. Special care is needed in laying out roads and landings and in operating equipment. During wet periods, unsurfaced roads tend to be slippery and ruts form easily. Year-round roads should be graveled. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets because of the slope. Cutting and filling can overcome a slope of less than 20 percent. Dwellings can be designed so that they conform to the natural slope of the land. Septic tank absorption fields and local roads and streets can be constructed on the contour. A slope of more than 20 percent is difficult to overcome, and a more suitable site should be selected. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water.

The land capability classification is VIe. The woodland ordination symbol is 3R.

PeA—Pelkie loamy fine sand, 1 to 3 percent slopes. This nearly level and gently sloping, deep, moderately well drained soil is on flood plains. It is subject to flooding. Areas commonly are dissected by old stream channels. Most are long and narrow and range from about 3 to 200 acres in size.

Typically, the surface layer is dark brown loamy fine sand about 2 inches thick. The upper part of the substratum is brown, very friable loamy fine sand. The next part is strong brown, loose fine sand. The lower part to a depth of about 60 inches is brown, mottled, loose fine sand and sand. In some areas the surface layer is loam or sandy loam. In places loamy or gravelly strata are in the substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Winterfield and Worcester soils in the slightly lower positions on the landscape. Worcester soils have a loamy mantle that is 26 to 40 inches thick. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Pelkie soil. The available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth of 2.5 to 5.0 feet during wet periods. It hinders root growth during these periods. Organic matter content is moderately low in the surface layer.

Most areas are used as woodland, wildlife habitat, or unimproved pasture. Some are used for crops or improved pasture. If protected from flooding, this soil is suited to corn and small grain and to grasses and legumes for hay and pasture. Yields generally are

limited, however, by the low available water capacity. Erosion generally is not a problem. Soil blowing is a hazard. It can be controlled by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways.

A cover of hay or pasture plants generally is effective in controlling soil blowing. Overgrazing, however, reduces the extent of the protective cover and thus increases the susceptibility to soil blowing. The best planting time is early in spring, before the surface layer dries out. Topdressing with suitable fertilizer and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Seedling survival rates are poor in dry years. They can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is generally unsuited to septic tank absorption fields, dwellings, and local roads or streets, mainly because of the flooding. This hazard is difficult to overcome, and a better suited site that is not on a flood plain should be selected.

The land capability classification is IVs. The woodland ordination symbol is 3A.

PkB—Pence sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping, deep, well drained soil is on flats and convex side slopes. Most areas are irregular in shape and range from about 10 to 400 acres in size.

Typically, the surface layer is black sandy loam about 1 inch thick. The subsurface layer is brown sandy loam about 1 inch thick. The subsoil is about 21 inches thick. It is dark brown, friable sandy loam in the upper part; brown, friable sandy loam in the next part; and brown, very friable loamy sand in the lower part. The substratum to a depth of about 60 inches is strong brown, loose, stratified sand and gravel. In some places the surface layer and subsoil are loamy sand. In other places the substratum is sand.

Included with this soil in mapping are small areas of the well drained Kennan and Padus soils. These soils are in positions on the landscape similar to those of the Pence soil. Kennan soils are underlain by sandy loam or loamy sand. Padus soils have a loamy mantle that is 24 to 40 inches thick. Also included are small areas where the slope is more than 6 percent, areas where the soil is very stony, and small areas where the depth to the water table is as shallow as 3 feet during wet periods. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of the Pence soil and rapid or very rapid in the lower part. The available water capacity is low. Surface runoff is slow or medium. Organic matter content is moderate or moderately low in the surface layer. This layer is friable and can be easily tilled.

Most areas are wooded. Some of these areas have been planted to pine. Some areas are used for crops or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay or pasture. During most years crop yields are limited, however, by the low available water capacity. If irrigated, the soil can produce better and more consistent yields. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Applications of fertilizer are needed.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Yields generally are low unless fertilizer and irrigation water are applied. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poor survival rate unless the soil is irrigated. Topdressing with suitable fertilizer and controlled grazing help to maintain the plant cover.

This soil is suited to trees. The vegetation that competes with natural regeneration following harvest can be controlled by suitable herbicides or mechanical removal. Seedling survival rates during dry periods can be improved by planting vigorous nursery stock.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is suited to dwellings and to local roads and streets.

The land capability classification is IIIe. The woodland ordination symbol is 7S.

PkC—Pence sandy loam, 6 to 15 percent slopes. This sloping and moderately steep, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 10 to 200 acres in size.

Typically, the surface layer is dark brown sandy loam about 8 inches thick. The subsoil is about 8 inches of brown, friable sandy loam and brown, very friable loamy sand. The substratum to a depth of about 60 inches is brown, loose, stratified sand and gravel. In some places the surface layer and subsoil are loamy sand. In other places the substratum is sand.

Included with this soil in mapping are small areas of Kennan, Minocqua, and Padus soils. The well drained Kennan and Padus soils are in positions on the landscape similar to those of the Pence soil. Kennan soils are underlain by sandy loam or loamy sand. Padus

soils have a loamy mantle that is 24 to 40 inches thick. The poorly drained and very poorly drained Minocqua soils are in depressions. Also included are small areas where the slope is less than 6 or more than 15 percent and areas where the soil is very stony. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of the Pence soil and rapid or very rapid in the lower part. The available water capacity is low. Surface runoff is medium. Organic matter content is moderate or moderately low in the surface layer.

Most areas are wooded. Some of these areas are planted to pine. Some areas are used for crops or pasture. This soil is suited to corn and small grain and to grasses and legumes for hay or pasture. If irrigated, the soil can produce better and more consistent yields. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Applications of fertilizer are needed.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of protective plant cover and thus increases susceptibility to erosion and soil blowing. Yields generally are low unless fertilizer and irrigation water are applied. The best planting time is early in spring, before the surface layer dries out. Topdressing with suitable fertilizer and controlled grazing help to maintain the plant cover.

This soil is suited to trees. The vegetation that competes with natural regeneration following harvest can be controlled by suitable herbicides or mechanical removal. Seedling survival rates during dry periods can be improved by planting vigorous nursery stock.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is only moderately suited to dwellings and to local roads and streets because of the slope. Cutting and filling can overcome this limitation.

The land capability classification is IVe. The woodland ordination symbol is 7S.

PkD—Pence sandy loam, 15 to 35 percent slopes. This moderately steep to very steep, deep, well drained soil is on convex side slopes and ridgetops. Most areas are irregularly shaped or long and narrow and range from about 10 to 200 acres in size.

Typically, the surface layer is dark reddish brown sandy loam about 3 inches thick. The subsoil is about 19 inches of dark brown, friable sandy loam and dark brown, very friable loamy sand. The substratum to a depth of about 60 inches is strong brown, loose gravelly coarse sand and sand. In some places the surface layer is fine sandy loam, loamy sand, or loam. In other places the subsoil and substratum are sand.

Included with this soil in mapping are small areas of Kennan, Minocqua, and Padus soils. The well drained Kennan and Padus soils are in positions on the landscape similar to those of the Pence soil. Kennan soils are underlain by sandy loam or loamy sand. Padus soils have a loamy mantle that is 24 to 40 inches thick. The poorly drained and very poorly drained Minocqua soils are in depressions. Also included are small areas where the slope is less than 15 percent, areas where the soil is very stony, and some small areas where the content of cobbles is more than 15 percent in the subsoil and substratum. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of the Pence soil and rapid or very rapid in the lower part. The available water capacity is low. Surface runoff is rapid. Organic matter content is moderate or moderately low in the surface layer.

Most areas are wooded. Some of these areas have been planted to pine. Some areas are used as pasture. Because of the low available water capacity, the hazard of soil blowing, and a very severe hazard of erosion, this soil generally is unsuited to cultivated crops. It is suited to pasture. Forage yields generally are limited, however, by the low available water capacity. Overgrazing reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Erosion is a hazard because runoff concentrates on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water by out-sloping road surfaces, culverts, and drop structures minimizes erosion. Building roads on the contour or on the gentler slopes also helps to control erosion. Seeding roads, trails, and landings after logging helps to establish a protective vegetative cover. The use of equipment is restricted because of the slope. Special care is needed in laying out roads and landings and in operating equipment. During wet periods, unsurfaced roads tend to be slippery and ruts form easily. Year-round roads should be graveled. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal. Seedling survival during dry periods can be improved by planting vigorous nursery stock.

This soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets because of the slope. Cutting and filling can overcome a slope of less than 20 percent. Dwellings can be designed so that they conform to the natural slope of the land. Septic tank absorption fields and local roads and streets can be constructed on the contour. A slope of more than 20

percent is difficult to overcome, and a more suitable site should be selected. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water.

The land capability classification is VIIe. The woodland ordination symbol is 7R.

PsD—Peshekee-Rock outcrop complex, 4 to 30 percent slopes. This map unit occurs as areas of a gently sloping to steep, shallow, well drained Peshekee soil intermingled with areas of Rock outcrop. The unit is on convex side slopes. Areas generally are irregular in shape and range from about 10 to 60 acres in size. They are 50 to 75 percent Peshekee soil and 20 to 45 percent Rock outcrop. The Peshekee soil and Rock outcrop occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Peshekee soil has a surface layer of dark brown fine sandy loam about 3 inches thick. The subsoil is dark brown and brown, friable fine sandy loam about 14 inches thick. Granite bedrock is at a depth of about 17 inches. In places the surface layer is loam, sandy loam, or loamy sand.

The Rock outcrop occurs as areas of bare granite bedrock. Nearly vertical bedrock escarpments are in some areas.

Included with this unit in mapping are small areas where the soil is more than 20 inches deep over bedrock and small areas where the soil is sandy. Also included are small areas where the subsoil has mottles. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Peshekee soil. The available water capacity is low. Surface runoff is slow to rapid. The granite bedrock hinders root penetration. Organic matter content is moderately low in the surface layer.

The Peshekee soil is wooded. It is generally unsuited to cultivated crops, hay, and pasture because of the depth to bedrock and the Rock outcrop. It is suited to trees. The soil-related management problems in the wooded areas are caused by the slope, especially where it is more than 18 percent. Removing water by out-sloping road surfaces, culverts, and drop structures minimizes erosion. Trees should be planted on the contour. Seeding roads, trails, and landings after logging helps to establish a protective vegetative cover. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees. Seedling survival rates can be improved by careful planting of vigorous planting stock.

Because of the shallow depth to granite bedrock and the slope, the Peshekee soil is generally unsuited to septic tank absorption fields, dwellings, and local roads and streets. These limitations are difficult to overcome, and a more suitable site should be selected.

The land capability classification is VIIs. The woodland ordination symbol is 2D for the Peshekee soil. Rock outcrop is not assigned a woodland ordination symbol.

Pt—Pits. These are excavations from which sand, gravel, glacial till, and dolomite have been removed. They are in areas of Bonduel, Fairport, Kiva, Oconto, Onaway, Padus, Pence, and Summerville soils. Areas are irregular in shape and range from about 10 to 70 acres in size.

Typically, the material on the bottom and sides of the pits is stratified sand and gravel, sand, loamy glacial till, or dolomite.

Included with this unit in mapping are areas of spoil. This spoil includes soil pushed from the pit area before excavation and piles of material that was discarded because it did not contain enough gravel or was otherwise unsuitable. Also included are areas of stones and boulders that cannot be crushed because they are too large.

Many pits are being excavated, but others have been abandoned. Some abandoned pits contain water. The main management concern is reclamation of the area after excavation. Land shaping and additions of suitable topsoil are needed before most areas can support a plant cover.

Onsite investigation is needed to determine the suitability of specific areas of this unit for septic tank absorption fields, dwellings, and local roads and streets.

No land capability classification or woodland ordination symbol is assigned.

RsB—Rousseau fine sand, 1 to 6 percent slopes. This nearly level and gently sloping, deep, moderately well drained soil is on low lying flats, convex side slopes, and concave foot slopes. Most areas are irregular in shape and range from about 3 to 350 acres in size.

Typically, the surface layer is very dark grayish brown fine sand about 8 inches thick. The subsoil is fine sand about 24 inches thick. The upper part is reddish brown and very friable, and the lower part is strong brown, mottled, and loose. The substratum to a depth of about 60 inches is brown and strong brown, mottled, loose fine sand. In a few areas the soil is eroded. In some places the substratum has thin layers of loamy material. In other places the content of fine sand is less than 50 percent throughout the soil.

Included with this soil in mapping are small areas of Menominee, Shawano, and Wainola soils. The well drained Menominee and excessively drained Shawano soils are slightly higher on the landscape than the Rousseau soil. Menominee soils are underlain by loamy deposits at a depth of 20 to 40 inches. The somewhat poorly drained Wainola soils are in drainageways and depressions. Also included are severely eroded areas. Included soils make up 8 to 10 percent of the unit.

Permeability is rapid in the Rousseau soil. The available water capacity is low. Surface runoff is slow in cultivated areas. The seasonal high water table is at a depth of 3 to 6 feet during wet periods. Organic matter content is very low or low in the surface layer.

Some areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. Crop yields generally are limited, however, by the low available water capacity. The soil is suited to sprinkler irrigation. It can produce better and more consistent yields if irrigation water and fertilizer are applied. Because of the rapid permeability, the irrigation rate should be controlled. If the rate is excessive, plant nutrients can be leached from the root zone. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways.

A cover of pasture plants or hay generally is effective in controlling soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to soil blowing. Forage yields generally are low unless fertilizer and irrigation water are applied. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poor survival rate unless the soil is irrigated. Applications of fertilizer, pasture renovation, irrigation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal. Loose sand can interfere with the traction of wheeled equipment. Landings should be stabilized, so that they can withstand repeated use of heavy equipment.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and the rapid permeability. Mounding with suitable filtering material helps to overcome these limitations. The soil is suited to dwellings without basements and to local roads and streets. It is only moderately suited to dwellings with basements because of the seasonal water table. Installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, or constructing the basement above the water table helps to overcome this limitation.

The land capability classification is IVs. The woodland ordination symbol is 3S.

Sb—Saprists and Aquents, ponded. These nearly level, very poorly drained soils are in depressions and along the edges of open bodies of water. They are ponded most of the year and are subject to flooding. Most areas are circular and range from about 5 to 500 acres in size.

These soils have a wide range of colors and textures. Typically, the Saprists are organic to a depth of 16 to more than 51 inches and the Aquents have a surface layer of mucky sandy loam about 12 inches thick. Both soils are underlain by sandy or loamy deposits that have thin strata of muck in places. In some areas gravel and stones are in the underlying deposits.

Permeability, available water capacity, and organic matter content in the surface layer vary. Surface runoff is ponded. The seasonal high water table is above or near the surface during much of the year. It hinders the root growth of most plants but does not restrict the growth of wetland plants.

Most areas are used as wetland wildlife habitat (fig. 7). These soils are unsuited to cultivated crops, hay, pasture, and trees because of the ponding. Most areas cannot be drained.

These soils are generally unsuited to septic tank absorption fields, dwellings, and local roads and streets because of the ponding and the flooding. Overcoming these hazards is difficult, and a more suitable site should be selected.

The land capability classification is VIIIw. These soils are not assigned a woodland ordination symbol.

Sd—Seelyeville and Markey mucks, 0 to 1 percent slopes. These nearly level, deep, very poorly drained soils are in upland depressions and drainageways. They are subject to ponding. Areas generally are irregular in shape and range from about 3 to 1,700 acres in size. They are entirely Seelyeville soil, entirely Markey soil, or a combination of both soils. The two soils are similar enough in morphology and behavior characteristics to be mapped together. Mapping them separately is not important for the objectives of the survey.

Typically, the Seelyeville soil is muck to a depth of more than 60 inches. It is very dark gray in the upper part and black and very dark brown in the lower part. In some areas more than 10 inches of mucky peat is below the surface layer.

Typically, the Markey soil is black and very dark brown muck to a depth of about 37 inches. The substratum to a depth of about 60 inches is dark grayish brown, loose sand. In some places the organic layer is underlain by loamy deposits. In other places the slope is more than 1 percent.

Included with these soils in mapping are small areas of the poorly drained and very poorly drained Cormant and Minocqua soils. These included soils are in positions on the landscape similar to those of the Seelyeville and Markey soils. They do not have an organic layer more than 16 inches thick. Also included are small areas where the soil is underlain by marl. Included soils make up 5 to 10 percent of the unit.

Figure 7.—An area of Saprists and Aquents, ponded. These soils provide habitat for wetland wildlife.

Permeability is moderately rapid in the Seelyeville and Markey soils. Available water capacity is very high. Surface runoff is very slow or ponded. Unless drained, these soils have a water table above or near the surface throughout the year. Organic matter content is very high in the surface layer.

Most areas are undrained and are wooded. A few small areas are drained and are used for crops. These soils generally are unsuited to cultivated crops because the growing season is limited by frost late in spring and early in fall. The drained areas are subject to burning, and the cultivated areas are subject to soil blowing. Excessive lowering of the water table increases the extent of subsidence.

Because of the high water table and the periodic ponding, undrained areas are unsuitable for most forage species. Reed canarygrass can be grown in these areas. In drained areas certain legumes, such as red clover, can be grown. The low strength of these soils, however, restricts the use of machinery and limits grazing.

These soils are suited to trees. The high water table during the planting season limits reforestation to natural regeneration. Harvesting with heavy equipment is limited to periods when the soil is frozen. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

These soils are generally unsuited to septic tank absorption fields because of the ponding, to dwellings because of the ponding and low strength, and to local roads and streets because of the ponding and a high potential for frost action. Overcoming these limitations is difficult, and a more suitable site should be selected.

The land capability classification is VIw. The woodland ordination symbol is 8W for the Seelyeville soil and 7W for the Markey soil.

SfB—Shawano fine sand, 2 to 6 percent slopes. This gently sloping, deep, excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 250 acres in size.

Typically, the surface layer is very dark brown fine sand about 4 inches thick. The subsoil is brown and strong brown, very friable fine sand about 25 inches thick. The substratum to a depth of about 60 inches is strong brown, loose fine sand. In some small areas the soil is eroded. In others the slope is less than 2 percent. In some places the surface layer is loamy fine sand. In other places thin strata of loamy sand are in the substratum. In some areas the content of fine sand is less than 50 percent throughout the soil.

Included with this soil in mapping are small areas of Menominee, Rousseau, and Wainola soils. The well drained Menominee soils are in positions on the landscape similar to those of the Shawano soil. They have a sandy mantle that is 20 to 40 inches deep over loamy deposits. The moderately well drained Rousseau soils are in the slightly lower landscape positions. The somewhat poorly drained Wainola soils are in drainageways and depressions. Also included are small areas where the soil is sloping and areas where it is severely eroded. Included soils make up about 10 to 15 percent of the unit.

Permeability is rapid in the Shawano soil. The available water capacity is low. Surface runoff is slow in cultivated areas. Organic matter content is low or very low in the surface layer. This layer is very friable and can be easily tilled.

Some areas are used for crops or pasture. Some are wooded. Some of the wooded areas have been planted to pine. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. Crop yields generally are limited, however, by the low available water capacity. The soil is suited to sprinkler irrigation, which can result in better and more consistent yields. Because of the rapid permeability, the irrigation rate should be controlled. If the rate is excessive, plant nutrients can be leached from the root zone. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Applications of fertilizer are needed.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing, however, reduces the extent of the protective cover and thus increases the susceptibility to erosion and soil blowing. Yields generally are low unless fertilizer and irrigation water are applied. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poor survival rate unless this soil is irrigated. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. The seedling survival rate can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is suited to dwellings and to local roads and streets.

The land capability classification is IVs. The woodland ordination symbol is 3S.

SfC—Shawano fine sand, 6 to 12 percent slopes. This sloping, deep, excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 100 acres in size.

Typically, the surface layer is very dark brown fine sand about 2 inches thick. The subsoil is very friable fine sand about 19 inches thick. It is dark brown and brown in the upper part and strong brown in the lower part. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand. In some places the soil is eroded. In other places the surface layer is loamy fine sand. In some areas thin strata of loamy sand are in the substratum. In other areas the content of fine sand is less than 50 percent throughout the soil.

Included with this soil in mapping are small areas of the well drained Menominee soils. These soils are in positions on the landscape similar to those of the Shawano soil. They have a sandy mantle that is 20 to 40 inches deep over loamy deposits. Also included are small areas where the slope is less than 6 or more than 12 percent and where the soil is severely eroded. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Shawano soil. The available water capacity is low. Surface runoff is medium in cultivated areas. Organic matter content is low or very low in the surface layer.

Some areas are used for crops or pasture. Some are wooded. Some of the wooded areas have been planted to pine. This soil is poorly suited to crops. During most years crop yields are limited by the low available water capacity. The soil is suited to sprinkler irrigation. If irrigated, it can produce better and more consistent yields. Because of the rapid permeability, the irrigation rate should be controlled. If the rate is excessive, plant nutrients can be leached from the root zone. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field

windbreaks; diversions; and grassed waterways. Applications of fertilizer are needed.

A cover of pasture plants or hay is effective in controlling erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Yields generally are low unless fertilizer and irrigation water are applied. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poor survival rate unless the soil is irrigated. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water. The soil is only moderately suited to dwellings and to local roads and streets because of the slope. Cutting and filling can overcome this limitation.

The land capability classification is VIs. The woodland ordination symbol is 3S.

SfD—Shawano fine sand, 12 to 30 percent slopes. This moderately steep and steep, deep, excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 100 acres in size.

Typically, the surface layer is very dark brown fine sand about 2 inches thick. The subsoil is strong brown, very friable fine sand about 19 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose fine sand. In some places the soil is eroded. In other places the surface layer is loamy fine sand. In some areas thin strata of loamy sand are in the substratum. In other areas the content of fine sand is less than 50 percent throughout the soil.

Included with this soil in mapping are small areas of the well drained Menominee soils. These soils are in positions on the landscape similar to those of the Shawano soil. They have a sandy mantle that is 20 to 40 inches deep over loamy deposits. Also included are small areas where the slope is less than 12 percent and areas where the soil is severely eroded. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Shawano soil. The available water capacity is low. Surface runoff is rapid in cultivated areas. Organic matter content is low or very low in the surface layer.

Most areas are wooded. Some of the wooded areas have been planted to pine. A few small areas are used for crops. These areas are mainly part of larger areas of less sloping soils. Because of the low available water capacity, a severe hazard of erosion, and the hazard of soil blowing, this soil generally is unsuitable for cultivated crops.

A cover of pasture plants or hay is effective in controlling erosion. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion and soil blowing. Forage yields generally are low because of the low available water capacity. The best planting time is early spring, before the surface layer dries out. A later planting time is likely to result in a poor survival rate. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Erosion is a hazard because runoff concentrates on skid trails, on logging roads, in the tracks of wheeled equipment, and on landings. Removing water by out-sloping road surfaces, culverts, and drop structures minimizes erosion. Seeding roads, trails, and landings after logging helps to establish a protective vegetative cover. The loose sand and the steep slopes can interfere with the traction of wheeled equipment. As a result, roads should be built on the contour or on the gentler slopes. Seedling survival on the steeper slopes facing south or west can be improved by careful planting of vigorous nursery stock. Competing vegetation, which competes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields, dwellings, and local roads and streets because of the slope. Cutting and filling can overcome a slope of less than 20 percent. Dwellings can be designed so that they conform to the natural slope of the land. Septic tank absorption fields and local roads and streets can be constructed on the contour. A slope of more than 20 percent is difficult to overcome, and a more suitable site should be selected. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity may result in the pollution of ground water.

The land capability classification is VIIs. The woodland ordination symbol is 3R.

ShA—Shiocton very fine sandy loam, 0 to 3 percent slopes. This nearly level and gently sloping, deep, somewhat poorly drained soil is on low lying flats, in drainageways and depressions, and on concave foot slopes. Most areas are irregular in shape and range from about 5 to 200 acres in size.

Typically, the surface layer is very dark grayish brown very fine sandy loam about 9 inches thick. The subsoil is friable very fine sandy loam about 13 inches thick. It is yellowish brown in the upper part, dark yellowish brown and mottled in the next part, and reddish brown and mottled in the lower part. The upper part of the substratum is brown, mottled, very friable very fine sandy loam. The lower part to a depth of about 60 inches is

brown and yellowish brown, mottled, very friable, stratified silt and very fine sand. In some areas the surface layer is silt loam, loam, sandy loam, or loamy sand. In some places the soil is underlain by sand or by sand and gravel at a depth of more than 40 inches. In other places it is underlain by loamy till.

Included with soil in mapping are small areas of Solona, Wainola, and Waupaca soils. The somewhat poorly drained Solona and Wainola soils are in positions on the landscape similar to those of the Shiocton soil. Solona soils formed in loamy till. Wainola soils are sandy throughout. The poorly drained Waupaca soils are in the lower positions on the landscape. Also included are some small areas of soils that have more sand and less silt in the subsoil than the Shiocton soil and some small areas where the substratum is silty clay loam or silty clay. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Shiocton soil. The available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 3 feet during wet periods. It hinders root growth during these periods. Organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled.

Drained areas are used for crops or pasture. Undrained areas provide wildlife habitat. Some are used as unimproved pasture. In the drained areas the soil is suited to corn and small grain. Surface drains remove excess surface water rapidly. Deep ditches and tile drains can improve subsurface drainage. Where drainage tile is installed in the underlying stratified deposits, loose sand can enter the tile lines unless a suitable filter is used. Unless protected by a plant cover, ditchbanks are easily eroded by flowing water. Vertical banks can cave in and plug the ditch.

If drained, this soil is suited to pasture and hay. Overgrazing reduces the extent of the protective plant cover and encourages the growth of undesirable plant species. Grazing when the surface layer is wet results in compaction and poor tilth and reduces the rate of water infiltration. Topdressing with suitable fertilizer and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges if natural regeneration is unreliable. Planting vigorous nursery stock reduces the seedling mortality rate. The use of equipment is restricted in the spring and other excessively wet periods. Ruts form easily when heavy, wheeled equipment is used during these periods. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields and dwellings because of the seasonal high water table. Mounding with suitable filtering material helps to overcome this limitation on sites for septic tank absorption fields. On sites for dwellings, the limitation can be overcome by installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, or by adding fill material, which raises the site.

Because of a high potential for frost action, this soil is poorly suited to local roads and streets. This hazard can be overcome by installing a subsurface drainage system in the roadbed and by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIw. The woodland ordination symbol is 3W.

SoA—Solona fine sandy loam, 0 to 3 percent slopes. This nearly level and gently sloping, deep, somewhat poorly drained soil is on low lying flats, in depressions and drainageways, and on concave foot slopes. Most areas are irregular in shape and range from about 3 to 1,000 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsoil is mottled, friable sandy loam about 13 inches thick. The upper part is brown, and the lower part is reddish brown. The substratum to a depth of about 60 inches is reddish brown, mottled, friable sandy loam. In some places the surface layer is silt loam, sandy loam, or loam. In other places the soil is underlain by stratified sand and gravel below a depth of 40 inches. In some areas the subsoil is silt or very fine sand.

Included with this soil in mapping are small areas of Bonduel, Ensley, Onaway, Shiocton, and Tilleda soils. The somewhat poorly drained Bonduel and Shiocton soils are in landscape positions similar to those of the Solona soil. Bonduel soils are underlain by dolomite bedrock at a depth of 20 to 40 inches. Shiocton soils formed in loamy lacustrine deposits underlain by silt and very fine sand. The poorly drained Ensley soils are lower on the landscape than the Solona soil. The well drained and moderately well drained Onaway and well drained Tilleda soils are higher on the landscape than the Solona soil. Also, they have more clay in the subsoil. Also included are small areas where dolomite bedrock is at a depth of 40 to 60 inches and small areas where the soil is sloping. Included soils make up 10 to 15 percent of the unit.

Permeability and the available water capacity are moderate in the Solona soil. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 3 feet during wet periods. It hinders root growth during these periods. Organic matter content is moderate or moderately low in the surface layer. This layer is friable and can be easily tilled.

Drained areas are used for crops or pasture. Undrained areas provide wildlife habitat. Some are used

as unimproved pasture. Some are wooded. In the drained areas this soil is suited to corn and small grain. Surface drains remove excess surface water rapidly. Deep ditches and tile drains can improve subsurface drainage. Unless protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks can cave in and plug the ditch. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

If drained, this soil is suited to pasture and hay. Overgrazing reduces the extent of the protective plant cover and encourages the growth of undesirable plant species. Grazing when the surface layer is wet results in surface compaction and poor tilth and reduces the rate of water infiltration. Applications of fertilizer, pasture renovation, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges if natural regeneration is unreliable. Planting vigorous nursery stock reduces the seedling mortality rate. The use of equipment is restricted in the spring and other excessively wet periods. Ruts form easily when heavy, wheeled equipment is used during these periods. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining threes. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields and dwellings because of the seasonal high water table. Mounding with suitable filtering material helps to overcome this limitation on sites for septic tank absorption fields. On sites for dwellings, the limitation can be overcome by installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, or by adding fill material, which raises the site.

Because of a high potential for frost action, this soil is poorly suited to local roads and streets. This hazard can be overcome by installing a subsurface drainage system in the roadbed and by covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIw. The woodland ordination is 3w.

SpB—Solona-Onaway fine sandy loams, 1 to 6 percent slopes. These nearly level and gently sloping, deep soils are on moraines. The somewhat poorly drained Solona soil is in depressions and drainageways. The moderately well drained Onaway soil is on knolls (fig. 8). Areas generally are irregular in shape and range from about 5 to 1,500 acres in size. They are 50 to 65 percent Solona soil and 25 to 45 percent Onaway soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Solona soil has a surface layer of dark brown fine sandy loam about 9 inches thick. The subsoil is mottled, friable sandy loam about 13 inches thick. The upper part is brown, and the lower part is reddish brown. The substratum to a depth of about 60 inches is reddish brown, mottled, friable sandy loam. In some places the surface layer is silt loam, sandy loam, or loam. In other places the soil is underlain by stratified sand and gravel below a depth of 40 inches.

Typically, the Onaway soil has a surface layer of dark brown fine sandy loam about 10 inches thick. The upper subsoil is brown, friable sandy loam about 6 inches thick. The next 5 inches is mixed reddish brown, firm clay loam and brown, friable sandy loam. The lower subsoil is about 10 inches of reddish brown, firm clay loam and brown, friable sandy loam. The substratum to a depth of about 60 inches is brown, mottled, friable sandy loam. In some areas the soil is eroded. In places the surface layer is silt loam or loam.

Included with these soils in mapping are small areas of Bonduel, Ensley, Menominee, and Shiocton soils. The somewhat poorly drained Bonduel and Shiocton soils are in positions on the landscape similar to those of the Solona and Onaway soils. Bonduel soils are underlain by dolomite bedrock at a depth of 20 to 40 inches. Shiocton soils formed in loamy deposits underlain by stratified silt and very fine sand. The poorly drained and very poorly drained Ensley soils are in drainageways and depressions. The well drained Menominee soils are in the slightly higher landscape positions. They have a sandy mantle that is 20 to 40 inches thick. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Solona soil and moderately slow in the Onaway soil. The available water capacity is moderate in both soils. In cultivated areas surface runoff is slow on the the Solona soil and slow or medium on the Onaway soil. The seasonal high water table in the Solona soil is at a depth of 1 to 3 feet during wet periods. It hinders root growth. The seasonal high water table in the Onaway soil is at a depth of 3 to 6 feet during wet periods. Organic matter content is moderate or moderately low in the surface layer of both soils. This layer is friable and can be easily tilled.

Most areas are used for crops or pasture. In drained areas these soils are suited to corn and small grain. If the Onaway soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; contour stripcropping; diversions; and grassed waterways. Surface drains remove excess surface water rapidly. Deep ditches and tile drainage can improve subsurface drainage in the Solona soil. Unless protected by a plant cover, ditchbanks are easily eroded by flowing water. Vertical banks can cave in and plug the ditch. Regular additions

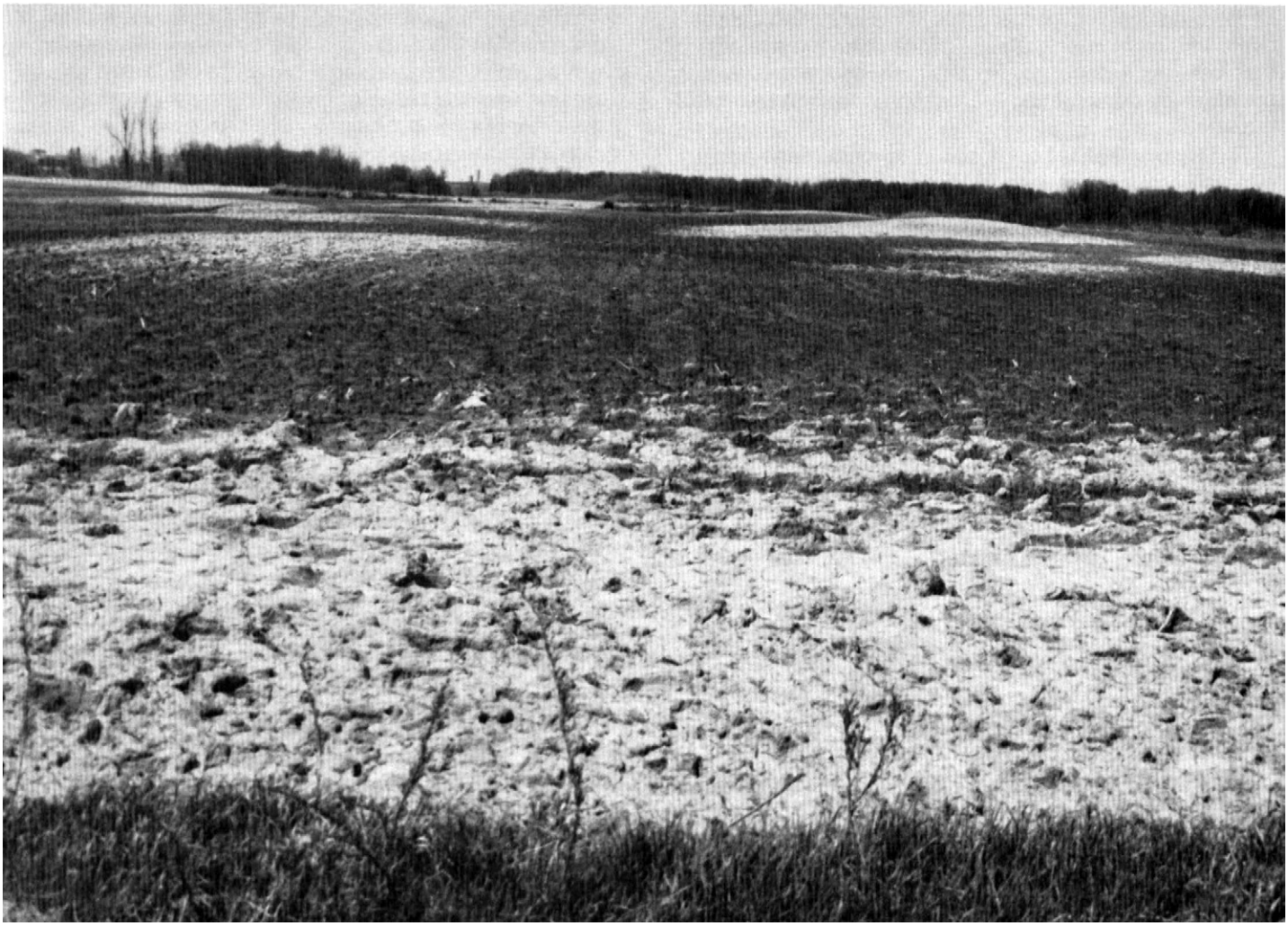

Figure 8.—An area of Solona-Onaway fine sandy loams, 1 to 6 percent slopes. The Onaway soil is in the lighter colored areas.

of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

If drained, these soils are suited to pasture and hay. Overgrazing reduces the extent of the protective plant cover, results in erosion, and encourages the growth of undesirable plant species. Grazing when the surface layer is wet results in surface compaction and poor tilth and reduces the rate of water infiltration. Applications of fertilizer, pasture renovation, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

These soils are suited to trees. Competing vegetation interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal. Because of the wetness of the Solona soil, the trees should be planted by hand or machine on prepared ridges if natural regeneration is unreliable. Planting vigorous nursery stock reduces the seedling mortality rate. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees.

These soils are poorly suited to septic tank absorption fields because of the seasonal high water table in both soils and the moderately slow permeability in the Onaway soil. Mounding with suitable filtering material helps to overcome these limitations. The Solona soil is poorly suited to dwellings because of the seasonal high water table. This limitation can be overcome by installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, or by adding fill material, which raises the site. The Onaway soil is suited to dwellings without basements. It is only moderately suited to dwellings with basements because

of the seasonal high water table. This limitation can be overcome by installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, or by constructing the basement above the water table.

The Solona soil is poorly suited to local roads and streets because of a high potential for frost action, and the Onaway soil is only moderately suited because of a moderate potential for frost action. Installing a subsurface drainage system in the roadbed and covering or replacing the upper part of the soil with coarse textured base material, such as sand or gravel, help to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 3w for the Solona soil and 3a for the Onaway soil.

SuB—Summerville fine sandy loam, 2 to 8 percent slopes. This gently sloping and sloping, shallow, well drained soil is on flats and convex side slopes. Most areas are irregular in shape and range from about 5 to 200 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsoil is about 7 inches of brown, friable sandy loam and dark reddish brown, friable loam. Dolomite bedrock is at a depth of about 15 inches. In places the surface layer is sandy loam, loam, or silt loam.

Included with this soil in mapping are small areas of Bonduel, Fairport, and Onaway soils. The somewhat poorly drained Bonduel soils are in the lower areas. They are 20 to 40 inches deep over dolomite. The well drained Fairport and well drained and moderately well drained Onaway soils are in positions on the landscape similar to those of the Summerville soil. Fairport soils are 20 to 40 inches deep over dolomite, and Onaway soils do not have dolomite within a depth of 60 inches. Also included are small areas where dolomite is within a depth of 12 inches and areas where the subsoil has mottles. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Summerville soil. The available water capacity is low. Surface runoff is slow or medium in cultivated areas. The underlying dolomite restricts root penetration. Organic matter content is moderately low in the surface layer.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to legumes and grasses for hay or pasture. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Grazing when the surface layer is wet results in surface compaction and poor tilth and increases the runoff rate and the hazard of erosion. Applications of fertilizer, pasture renovation, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The seedling survival rate during dry periods can be improved by careful planting of vigorous nursery stock. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees.

This soil is generally unsuited to septic tank absorption fields, dwellings, and local roads and streets because of the shallow depth to dolomite bedrock. Inadequately treated effluent flowing through crevices in the dolomite can pollute nearby water supplies. Excavations for dwellings and local roads require heavy-duty equipment and blasting. Because of the depth to bedrock, a more suitable building site should be selected.

The land capability classification is IIIe. The woodland ordination symbol is 2D.

SuE—Summerville fine sandy loam, 20 to 45 percent slopes. This steep and very steep, shallow, well drained soil is on escarpments. Most areas are long and narrow and range from about 20 to 50 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 3 inches thick. The subsurface layer is pinkish gray fine sandy loam about 1 inch thick. The subsoil is brown, friable fine sandy loam about 8 inches thick. The substratum is dark reddish brown, friable cobbly loam about 4 inches thick. Dolomite bedrock is at a depth of about 16 inches. In places the surface layer is loam, sandy loam, silt loam, or loamy sand.

Included with this soil in mapping are small areas of the well drained Fairport soils. These soils are in positions on the landscape similar to those of the Summerville soil. They are 20 to 40 inches deep over dolomite. Also included are small areas where dolomite is within a depth of 12 inches and small areas where the slope is less than 20 percent. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Summerville soil. The available water capacity is low. Surface runoff is very rapid. The underlying dolomite restricts root penetration. Organic matter content is moderately low in the surface layer.

Most areas are wooded. Because of a very severe hazard of erosion, this soil is generally unsuited to cultivated crops, hay, and pasture. It is suited to trees. Planting on the contour and carefully locating skid roads

during harvest minimize erosion. During wet periods, unsurfaced logging roads tend to be slippery and ruts form easily. Seedling survival rates on slopes facing south and west can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

Because of the shallow depth to dolomite bedrock and the slope, this soil is generally unsuited to septic tank absorption fields, dwellings, and local roads and streets. These limitations are difficult to overcome, and a more suitable site should be selected.

The land capability classification is VIIe. The woodland ordination symbol is 2R.

TIB—Tilleda fine sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping, deep, well drained soil is on flats and convex side slopes. Most areas are irregular in shape and range from about 3 to 600 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is about 8 inches thick. It is dominantly brown fine sandy loam. The subsoil is about 22 inches thick. It is dominantly reddish brown, friable loam. The substratum to a depth of about 60 inches also is reddish brown, friable loam. In places the surface layer is loamy sand, sandy loam, loam, or silt loam. In some areas the soil is eroded.

Included with this soil in mapping are small areas of Menominee and Solona soils. The well drained Menominee soils are in positions on the landscape similar to those of the Tilleda soil. They have a sandy mantle that is 20 to 40 inches thick. The somewhat poorly drained Solona soils are in drainageways and depressions. Also included are small areas where the slope is more than 6 percent, areas where the soil is very stony or severely eroded, some small areas where the depth to the water table is as shallow as 3 feet, and small areas of soils that have less clay or more clay in the subsoil than the Tilleda soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Tilleda soil. The available water capacity is high. Surface runoff is slow or medium in cultivated areas. Organic matter content is moderate or moderately low in the surface layer. This layer is friable and can be easily tilled.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. If the soil is cultivated, erosion is a slight or moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Grazing when the surface layer is wet results in surface compaction and poor tilth and increases the runoff rate and the hazard of erosion. Applications of fertilizer, pasture renovation, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil is only moderately suited to septic tank absorption fields because of the moderate permeability. Mounding with suitable filtering material or enlarging the absorption field helps to overcome this limitation. The soil is only moderately suited to dwellings without basements because of the shrink-swell potential. Replacing the soil under the footings and concrete slab with coarse textured material, such as sand or gravel, helps to overcome this limitation. The soil is suited to dwellings with basements.

Because of a moderate potential for frost action and low strength, this soil is only moderately suited to local roads and streets. The damage caused by frost action and low strength can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIe. The woodland ordination symbol is 4A.

TIC2—Tilleda fine sandy loam, 6 to 15 percent slopes, eroded. This sloping and moderately steep, deep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 75 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 5 inches thick. In most tilled areas plowing has mixed dark reddish brown material into the surface layer. The next 15 inches is mixed dark reddish brown, friable loam and brown, friable fine sandy loam. The subsoil is dark reddish brown, friable loam about 16 inches thick. The substratum to a depth of about 60 inches is reddish brown, friable loam. In some areas the soil is not eroded. In places the surface layer is loamy sand, sandy loam, loam, or silt loam.

Included with this soil in mapping are small areas of the excessively drained Menahga and well drained Menominee soils. These soils are in positions on the landscape similar to those of the Tilleda soil. Menahga soils are sandy throughout. Menominee soils have a sandy mantle that is 20 to 40 inches thick. Also included are small areas where the slope is less than 6 or more

than 15 percent, areas where the soil is severely eroded, and small areas of soils that have less clay or more clay in the subsoil than the Tilleda soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Tilleda soil. The available water capacity is high. Surface runoff is medium in cultivated areas. Organic matter content is moderate or moderately low in the surface layer. This layer is difficult to till because plowing has mixed it with loam from the subsoil.

Most areas are used for crops or pasture. Some are wooded. This soil is suited to corn and small grain and to legumes and grasses for hay and pasture. If the soil is cultivated, erosion is a moderate hazard and soil blowing can occur. Soil loss can be reduced by proper management of crop residue; a conservation tillage system, such as chisel plowing, that leaves a protective amount of crop residue on the surface; contour farming; wind stripcropping and contour stripcropping; field windbreaks; diversions; and grassed waterways. Regular additions of organic material help to maintain fertility and good tilth and increase the rate of water infiltration.

A cover of pasture plants or hay helps to control erosion and soil blowing. Overgrazing, however, reduces the extent of the protective plant cover and thus increases the susceptibility to erosion. Grazing when the surface layer is wet results in surface compaction and poor tilth and increases the runoff rate and the hazard of erosion. Applications of fertilizer, pasture renovation, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. The only soil-related management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled by suitable herbicides or mechanical removal.

This soil is only moderately suited to septic tank absorption fields because of the moderate permeability and the slope. Mounding with suitable filtering material or enlarging the absorption field helps to overcome the moderate permeability. Cutting and filling or installing a trench absorption system on the contour helps to overcome the slope. The soil is only moderately suited to dwellings with basements because of the slope and to dwellings without basements because of the slope and the shrink-swell potential. Replacing the soil near the foundation with coarse textured material, such as sand or gravel, helps to overcome the shrink-swell potential. Cutting and filling can overcome the slope.

Because of the slope, low strength, and a moderate potential for frost action, this soil is only moderately suited to local roads and streets. Cutting and filling help to overcome the slope. The damage caused by low strength and frost action can be minimized by replacing the upper part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

WaA—Wainola loamy fine sand, 0 to 3 percent slopes. This nearly level and gently sloping, deep, somewhat poorly drained soil is on low lying flats, in drainageways and depressions, and on concave foot slopes. Most areas are irregular in shape and range from 3 to 300 acres in size.

Typically, the surface layer is black loamy fine sand about 3 inches thick. The subsurface layer is brown, very friable fine sand about 6 inches thick. The subsoil is dark yellowish brown and dark brown, mottled, very friable fine sand about 21 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled, loose fine sand. In some places the surface layer is fine sandy loam or fine sand. In other places the content of fine sand is less than 50 percent throughout the soil.

Included with this soil in mapping are small areas of Cormant, Iosco, and Rousseau soils. The poorly drained and very poorly drained Cormant soils are in depressions and drainageways. The somewhat poorly drained Iosco soils are in positions on the landscape similar to those of the Wainola soil. They are underlain by loamy deposits below a depth of 20 inches. The moderately well drained Rousseau soils are on small knolls. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Wainola soil. The available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 3 feet during wet periods. It hinders root growth during these periods. Organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled.

Drained areas are used for crops or pasture. Undrained areas provide wildlife habitat. Some are used as unimproved pasture. Some are wooded. In the drained areas this soil is suited to corn and small grain. Surface drains remove excess surface water rapidly. Deep ditches and tile drains can improve subsurface drainage. Where tile drains are installed, loose sand can enter the tile lines unless a suitable filter is used. Unless protected by a plant cover, ditchbanks are easily eroded by flowing water. Vertical banks can cave in and plug the ditch. If the soil is drained and cultivated, soil blowing is a hazard. It can be controlled by proper management of crop residue; a conservation tillage system, such as chisel plowing; wind stripcropping; and field windbreaks.

Where the water table is lowered excessively, crop yields are limited by the low available water capacity during most years. The soil is suited to sprinkler irrigation. Because of the rapid permeability, the irrigation rate should be controlled. If the rate is excessive, plant nutrients can be leached from the root zone. Applications of fertilizer are needed.

A cover of pasture plants or hay is effective in controlling soil blowing. Overgrazing, however, reduces

the extent of the protective plant cover and increases the susceptibility to soil blowing. If drained and otherwise well managed, this soil is suited to pasture and hay. Forage yields, however, generally are low unless fertilizer and irrigation water are applied. The best planting time is early in spring, before the surface layer dries out. A later planting time is likely to result in a poor survival rate unless the soil is irrigated. Applications of fertilizer, pasture renovation, and controlled grazing help to maintain the plant cover.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges if natural regeneration is unreliable. The use of equipment is restricted in the spring and other excessively wet periods. Ruts form easily when heavy, wheeled equipment is used during these periods. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and the rapid permeability. Mounding with suitable filtering material helps to overcome these limitations. The soil is poorly suited to dwellings and to local roads and streets because of the seasonal high water table. This limitation can be overcome by installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, or by adding fill material, which raises the building site or roadbed.

The land capability classification is IVw. The woodland ordination symbol is 8W.

Wd—Waupaca very fine sandy loam, 0 to 2 percent slopes. This nearly level, deep, poorly drained soil is on low lying flats and in depressions and drainageways. It is subject to flooding and ponding. Most areas are irregular in shape and range from about 3 to 100 acres in size.

Typically, the surface layer is black very fine sandy loam about 9 inches thick. The substratum to a depth of about 60 inches is silt loam. The upper part is light brownish gray and brown, mottled, and friable, and the lower part is grayish brown and very friable. In some places the surface layer is mucky silt loam, silt loam, or loam. In other places the substratum is stratified loamy very fine sand, very fine sandy loam, and silt or is underlain by sand and gravel below a depth of 40 inches.

Included with this soil in mapping are small areas of Cormant, Ensley, Markey, and Shiocton soils. The poorly drained and very poorly drained Cormant and Ensley soils are in positions on the landscape similar to those of the Waupaca soil. Cormant soils are sandy throughout, and Ensley soils formed in loamy glacial till. The very poorly drained Markey soils are organic to a depth of 16 to 51 inches. They are in landscape positions similar to those of the Waupaca soil or are slightly lower on the landscape. The somewhat poorly drained Shiocton soils are in the slightly higher landscape positions. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Waupaca soil. The available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is above or near the surface much of the year. It hinders root growth. Organic matter content is moderate or high in the surface layer. This layer is friable and can be easily tilled.

Most areas are used as woodland, wildlife habitat, or unimproved pasture. Some areas are drained and are used for crops or pasture. If drained and protected from flooding, this soil is suited to corn and small grain. Surface drains remove excess surface water rapidly. Deep ditches and tile drains can improve subsurface drainage. In tiled areas very fine sand and silt can enter the tile lines unless a suitable filter is used. Unless protected by a plant cover, ditchbanks are easily eroded. Vertical banks can cave in and plug the ditch.

Because of the high water table, the periodic ponding, and the flooding, undrained areas are unsuitable for most forage species. They can be used only for such species as reed canarygrass and Garrison creeping foxtail. If proper management is applied, certain legumes and grasses can be grown in drained areas. Overgrazing reduces the extent of the protective plant cover and encourages the growth of undesirable plant species. Grazing when the surface layer is wet results in surface compaction and poor tilth and reduces the rate of water infiltration. Topdressing with suitable fertilizer, controlled grazing, and restricted use during wet periods help to keep the plant cover in good condition.

This soil is suited to trees. Because of the wetness, the trees should be planted by hand or machine on prepared ridges if natural regeneration is unreliable. Planting vigorous nursery stock reduces the seedling mortality rate. The use of equipment is restricted in the spring and other excessively wet periods. Ruts form easily when heavy equipment is used during these periods. Year-round logging roads should be graveled. Harvesting is frequently limited to periods when the soil is frozen. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is generally unsuited to septic tank absorption fields, dwellings, and local roads and streets, mainly because of the frequent flooding and the ponding. Overcoming these hazards is difficult, and a more suitable site should be selected.

The land capability classification is Vlw. The woodland ordination symbol is 3W.

Wf—Winterfield fine sandy loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on flood plains. It is subject to flooding (fig. 9). Areas commonly are dissected by old stream channels. Most are long and narrow and range from 5 to 500 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 4 inches thick. The upper part of the substratum is brown, very friable loamy fine sand. The next part is yellowish brown and dark brown, mottled, loose fine sand. The lower part to a depth of about 60 inches is brown and reddish brown, mottled, loose fine sand and sand. In some places the surface layer is loam, silt loam, loamy sand, or sand. In other places the substratum has strata of sandy loam, loam, or sand and gravel.

Figure 9.—A flooded area of Winterfield fine sandy loam, 0 to 2 percent slopes.

Included with this soil in mapping are small areas of Markey and Pelkie soils. The very poorly drained Markey soils are lower on the landscape than the Winterfield soil. They are organic to a depth of 16 to 51 inches. The moderately well drained Pelkie soils are in the slightly higher positions on the landscape. Also included are small areas where the soil has a loamy alluvial mantle as much as 30 inches thick. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Winterfield soil. The available water capacity is low. Surface runoff is slow. The water table is at a depth of 1 to 2 feet during wet periods. It hinders root growth during these periods. Organic matter content is moderate in the surface layer.

Most areas are used as woodland, wildlife habitat, or unimproved pasture. This soil is generally unsuitable for cultivated crops because of the high water table and the frequent flooding. Most areas cannot be drained. Because of the high water table and the frequent flooding, the soil is unsuitable for most forage species. It can be used only for such species as reed canarygrass.

This soil is suited to trees. Seedling survival can be improved by careful planting of vigorous nursery stock. The use of equipment is restricted in the spring and other excessively wet periods. Ruts form easily when heavy, wheeled equipment is used during these periods. Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.

This soil is generally unsuited to septic tank absorption fields, dwellings, and local roads and streets, mainly because of the frequent flooding and the seasonal high water table. Overcoming these limitations is difficult, and a more suitable site should be selected.

The land capability classification is VIIw. The woodland ordination symbol is 3W.

WrA—Worcester loam, 0 to 3 percent slopes. This nearly level and gently sloping, deep, somewhat poorly drained soil is on low lying flats and in depressions and drainageways. Most areas are irregular in shape and range from about 4 to 70 acres in size.

Typically, the surface layer is black loam about 1 inch thick. The subsurface layer is grayish brown loam about 3 inches thick. The upper subsoil is about 11 inches of dark reddish brown, very friable sandy loam and brown, mottled, friable sandy loam. The next 5 inches is brown, mottled, friable sandy loam. The lower subsoil is brown, mottled, friable loam about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose, stratified sand and very gravelly sand. In some areas the surface layer is silt loam or sandy loam. In some places the substratum is sandy loam or loamy sand. In other places it is calcareous sand and gravel.

Included with this soil in mapping are small areas of Minocqua and Padus soils. The poorly drained and very poorly drained Minocqua soils are in the lower landscape positions. The well drained Padus soils are in the higher landscape positions. Also included are areas where the soil is stony and some areas where the depth to sand and gravel is less than 20 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Worcester soil and rapid or very rapid in the lower part. The available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 3 feet during wet periods. It hinders root growth during these periods. Organic matter content is moderate or moderately low in the surface layer. This layer is friable and can be easily tilled.

Drained areas are used for crops or pasture. Undrained areas provide wildlife habitat. Some are used as unimproved pasture. Many are wooded. In the drained areas this soil is suited to corn and small grain. Surface drains remove excess surface water rapidly. Deep ditches and tile drains can improve subsurface drainage. In tiled areas loose sand can enter the tile lines unless a suitable filter is used. Unless protected by a plant cover, ditchbanks are easily eroded by flowing water. Vertical banks can cave in and plug the ditch. Regular additions of organic material help to maintain fertility and good tilth.

If drained, this soil is suited to pasture and hay. Overgrazing reduces the extent of the protective plant cover and encourages the growth of undesirable plant species. Grazing when the surface layer is wet results in surface compaction and poor tilth and reduces the rate of water infiltration. Applications of fertilizer, pasture renovation, and controlled grazing help to keep the plant cover in good condition.

This soil is suited to trees. The use of equipment is restricted in the spring and other excessively wet periods. Ruts form easily when heavy, wheeled equipment is used during these periods. Harvesting by clearcut or area-selection methods helps to prevent windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and the rapid or very rapid permeability. Mounding with suitable filtering material helps to overcome these limitations. The effluent could be pumped to an absorption field in a higher area where the soil is suitable.

This soil is poorly suited to dwellings because of the seasonal high water table. This limitation can be overcome by installing a subsurface drainage system that includes a dependable outlet, such as a gravity outlet, or by adding fill material, which raises the site.

Because of a high potential for frost action, this soil is poorly suited to local roads and streets. This hazard can be overcome by installing a subsurface drainage system in the roadbed and by covering or replacing the upper

part of the soil with coarse textured base material, such as sand or gravel.

The land capability classification is IIw. The woodland ordination symbol is 2W.

Prime Farmland

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

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

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

About 193,000 acres in the county, or 30 percent of the total land area, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in associations 5, 6, and 7, which are described under the heading "General Soil Map Units." About 150,000 acres of this prime farmland is used for crops. The crops grown on this land, mainly corn and alfalfa, account for an estimated two-thirds of the county's total agricultural income each year.

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

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

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

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

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

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

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

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

Crops and Pasture

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

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

About 261,000 acres in Oconto County was farmland in 1982. Of this total, about 43,000 acres was used for alfalfa hay; 59,000 acres for row crops, mainly corn; and 20,000 acres for small grain, mainly oats. The remaining acreage was idle cropland, was wooded, or was used for specialty crops.

The soils in Oconto County have good potential for increased production for crops. About 120,000 acres of potentially good cropland is wooded, and about 15,000 acres is idle. Food production can be increased considerably by applying the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology. The paragraphs that follow describe the major management concerns on the cropland and pasture in the county.

Water erosion is the major problem on about 47 percent of the cropland and pasture in the county. It is a hazard in areas where the slope is more than 2 percent.

Loss of the surface layer through erosion reduces productivity and results in sedimentation of streams. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Erosion especially reduces the productivity of soils that have a clayey subsoil, such as Nester soils, and soils that are only moderately deep over bedrock, such as Fairport soils. It also reduces the productivity of soils that tend to be droughty, such as Menahga and Shawano soils. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and other wildlife.

Erosion-control measures provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the soil for extended periods can reduce soil losses to an amount that will not reduce the productive capacity of the soil. On dairy farms, where pasture and hay are needed, including legumes and grasses in the cropping sequence helps to control erosion on sloping land and

provides nitrogen and improves tilth for the other crops grown in the rotation.

Applying a system of conservation tillage and leaving crop residue on the surface increase the rate of water infiltration and reduce the hazards of runoff and erosion. These measures can be applied on most of the soils in the county. They are less successful, however, on eroded soils.

Diversions shorten the length of slopes and reduce the hazards of runoff and erosion. Contour farming and stripcropping reduce the runoff rate. Grassed waterways help to control erosion in channels and increase the amount of water that penetrates the surface by slowing down the runoff.

Further information about the design of erosion-control measures for each kind of soil is contained in the Technical Guide, which is available at the local office of the Soil Conservation Service.

Soil blowing is a hazard on the sandy Brevort, Cormant, Iosco, Keweenaw, Mancelona, Menahga, Menominee, Rousseau, Shawano, and Wainola soils and on the organic Markey and Seelyeville soils. It also is a hazard on Fairport, Fence, Kennan, Kiva, Minocqua, Oconto, Onaway, Padus, Pence, and Tilleda soils. Soil blowing can damage these soils in a few hours if the wind is strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a plant cover, surface mulching, wind stripcropping, and establishing field windbreaks reduce the hazard of soil blowing.

Soil drainage is a major management need on about 25 percent of the acreage used for crops and pasture in the county. Unless drained, some soils are naturally so wet that the production of the crops commonly grown in the county is generally not possible. These are the poorly drained and very poorly drained, mineral Brevort, Cormant, Ensley, Minocqua, and Waupaca soils and the very poorly drained, organic Loxley, Markey, and Seelyeville soils. Unless drained, the somewhat poorly drained soils are so wet that crops are damaged during most years. These include Bonduel, Iosco, Shiocton, Solona, Wainola, and Worcester soils.

The design of both surface and subsurface drainage systems depends on the kind of soil and the site conditions. A combination of surface and subsurface drains is needed in most areas of the poorly drained and very poorly drained soils used for intensive row cropping. Diversions are needed in some areas to control the runoff from the adjacent slopes.

If organic soils are drained and used as cropland, special management is necessary. When their pore space is filled with air, these soils oxidize and subside. A drainage system that controls the depth and period of drainage is needed. Keeping the water table at the level required by the crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of these soils.

Because of a low position on the landscape, crops grown in most areas of poorly drained and very poorly drained soils are subject to frost damage. The number of frost-free growing days is less on these soils than on the adjacent upland soils because of cold air drainage to the lower areas.

Information about the design of drainage systems for each kind of soil is contained in the Technical Guide, which is available at the local office of the Soil Conservation Service.

Soil fertility varies in Oconto County. Many of the soils in the northwestern part of the county are deeply weathered and are acid. If these soils have never been limed, applications of ground limestone are needed to raise the pH level sufficiently for alfalfa and other crops that grow best where reaction is near neutral. Available potassium levels are naturally low in many soils in the county. On all soils additions of lime and fertilizer should be based on the results of soils 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 be applied.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. Tilling or grazing when the soil is too wet can cause poor tilth, especially in soils that have a loam or silt loam surface layer. Intensive rainfall on a bare soil can cause the formation of a surface crust that reduces the rate of water infiltration and increases the runoff rate and the susceptibility to erosion. Maintaining good tilth is especially difficult on eroded soils because they generally have a lower content of organic matter than uneroded soils. Returning crop residue to the soil and regularly adding manure or other organic material improve tilth.

Field crops suited to the soils and climate of the county include many that are not commonly grown. Corn is the chief row crop. Much of this crop is used for silage. Some sunflowers also are grown. Oats is the most common small grain crop. A small acreage is used for wheat, barley, or rye. Because of the predominance of dairying, hay is an important crop. A mixture of bromegrass and alfalfa is the dominant hay crop, but red clover, alsike clover, and timothy also are grown. The wet, loamy soils in the county are well suited to birdsfoot trefoil.

Yields of native bluegrass pasture are included in the yields table because bluegrass is commonly grown on many soils that are too wet or too steep for pasture renovation or the production of row crops.

Specialty crops grown commercially in the county include vegetables, mint, and apples. The most common vegetables are sweet corn, yellow and green beans, peas, potatoes, cucumbers, onions, and carrots. A small acreage is used for tomatoes, melons, strawberries,

raspberries, squash, and many other specialty crops. Many of the soils in the county that have good natural drainage and warm up early in spring are suited to a wide variety of vegetables and small fruits. Information about growing these 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 land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents (*4*). Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*9*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

George W. Alley, forester, Soil Conservation Service, helped prepare this section.

Most of Oconto County was forested prior to settlement. Logging, fires, and agricultural activities have reduced the forested acreage and altered the remaining forest. About 347,000 acres, or 54 percent of the total land area, remains commercial forest. About 1 percent is noncommercial forest. About 171,000 acres is publicly owned forest. Most of the public forest is in the Nicolet National Forest, in the northwestern part of the county. About 44,000 acres is forest owned by Oconto County. Farmers and other private individuals own about 175,000 forested acres. Forest industry holdings make up about 5,500 acres.

The largest and most important areas of woodland are in soil associations 1, 2, and 3, which are described under the heading "General Soil Map Units." The woodland is about 32 percent the aspen-paper birch forest type, 24 percent pine and other conifers, 42 percent sugar maple and other northern hardwoods, and 2 percent nonstocked (*12*).

The occurrence of forest fires has been brought under control in the county. The greatest management need is the removal of the defective trees and less desirable species in privately owned stands. The public forest land generally is adequately managed. Many of the pines planted on sandy soils are now large enough to need pruning and thinning.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and

winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production. Additional information about these trees is available from the local office of the Soil Conservation Service.

Additional information about woodland management and productivity can be obtained from the Wisconsin Department of Natural Resources, the local office of the Soil Conservation Service, or the Cooperative Extension Service.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 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, from the Wisconsin Department of Natural Resources, or from a commercial nursery.

Recreation

The many lakes, streams, and wooded areas in Oconto County attract numerous vacationers (fig. 10). More than 300 lakes and 25 miles of the Green Bay shoreline provide opportunities for water sports.

The large wooded tracts, particularly those in the northern part of the county, have many areas of scenic and geologic interest. These areas are used for camping, hiking, fishing, boating, skiing, and picnicking. The public lands available for recreation include the Nicolet National Forest, the forested acreage owned by Oconto County, 28 parks, and many wildlife areas.

The soils of the survey area are rated in table 9 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 9, 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 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

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

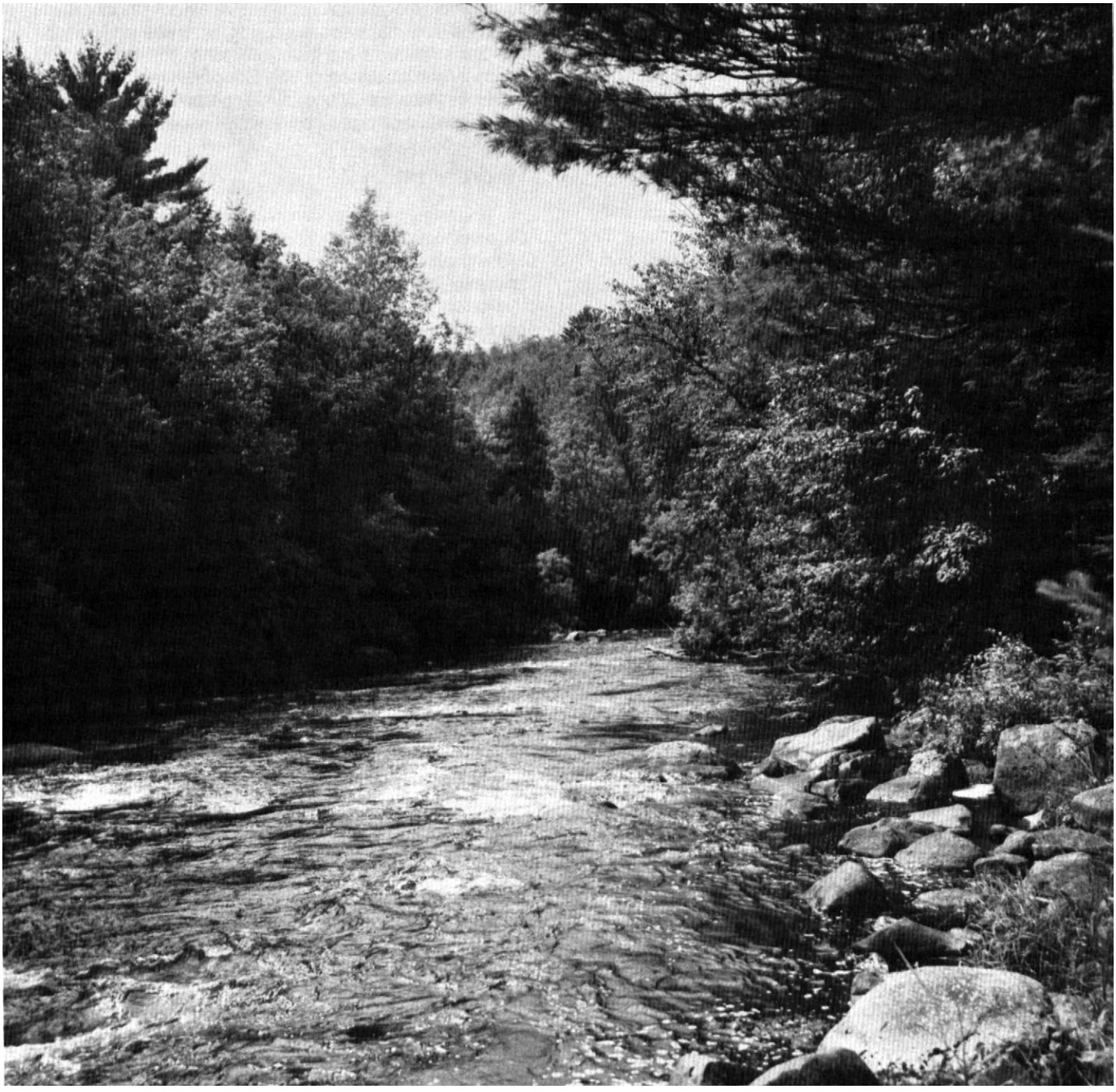

Figure 10.—The Oconto River provides opportunities for many recreational activities.

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 and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Thomas P. Thrall, biologist, Soil Conservation Service, helped prepare this section.

Oconto County has numerous and diverse wildlife. The large acreage of wetlands is extremely important because it provides habitat diversity. Most of the wetlands are forested and provide valuable habitat for many species. Some of the open wetlands provide habitat for mallards, blue-winged teal, and other waterfowl and for furbearers.

The paragraphs that follow specify the kinds of habitat and wildlife species in areas of the soil associations described under the heading "General Soil Map Units." Some associations have been combined because their land uses and cover types are similar.

Most of the acreage in associations 1 and 2 is part of the Nicolet National Forest. These associations support a wide range of both hardwoods and softwoods. They are inhabited by a large variety of wilderness wildlife, such as black bear, bobcat, otter, beaver, deer, coyote, snowshoe hare, and porcupine. A few fishers inhabit these associations. A population of turkeys has been established as a result of past stocking by the Forest Service.

Areas of these associations include numerous lakes and most of the trout streams in the county. The lakes and streams in the part of the Nicolet National Forest that is in Oconto County are generally the most productive fishing waters in the Nicolet system.

Association 3 includes large areas of county forest. The major timber species are jack pine, red pine, northern pin oak, northern red oak, paper birch, and aspen. Wildlife species include white-tailed deer, red fox, raccoon, squirrels, and ruffed grouse. Much of the existing cover type is being converted to plantations of red pine. The existing cover type provides high-quality deer and grouse habitat, but increased conversion to red pine will decrease the population of these species. Most of the Thunder River deeryard is in this association. This is an important deeryard in the county. Black bear inhabit the more remote areas. Intermixed lowlands and riparian habitat add some diversity. The wildlife along the stream corridors include beaver, muskrat, otter, and mink.

Areas of the very poorly drained, organic soils in association 4 provide habitat for white-tailed deer. Areas of this association in the northern part of the county also provide habitat for black bear. The Brazeau Swamp, which is in this association, is one of the two major deeryards in the county. The woody vegetation includes northern white-cedar, hemlock, balsam fir, willow, and alder.

Associations 5, 6, and 7 are used mainly as cropland. Corn and alfalfa are the principal crops. Substantial stands of the upland and lowland forest types are throughout these associations. This woodland provides habitat for gray squirrels, fox squirrels, and ruffed grouse. The edge effect created by the combination of woodland and cropland provides favorable habitat for cottontail rabbits, red fox, raccoons, and white-tailed deer. Muskrats and other furbearers inhabit the riparian habitat along the streams. Scattered small areas of open wetlands are inhabited by waterfowl, primarily mallards and blue-winged teal. Hungarian partridge inhabits the areas of these associations in the southern part of the county.

The soils in association 8 have a high water table. This association is adjacent to Green Bay. It provides critical habitat for waterfowl. It includes wetlands wooded with ash, northern white-cedar, red maple, aspen, and willow. It also includes some open wetlands. It is considered good deer range and has some good habitat for grouse. A good population of furbearers also inhabits this association. Areas of cropland provide some habitat diversity.

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 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and

other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are timothy, 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 curly dock, goldenrod, smartweed, and ragweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, maple, basswood, ninebark, dogwood, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are dogwood, highbush cranberry, elderberry, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, 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 red-tailed hawk, meadowlark, field sparrow, bobolink, bluebird, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, bear, and bobcat.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, otter, 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, 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 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock 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, large stones, slope, 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, 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, the

available water capacity in the upper 40 inches, and the content of salts 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 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 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, and flooding affect absorption of the effluent. Large stones and bedrock 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 filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 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, 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 and bedrock 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 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, 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 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 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 13 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 (fig. 11). 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.

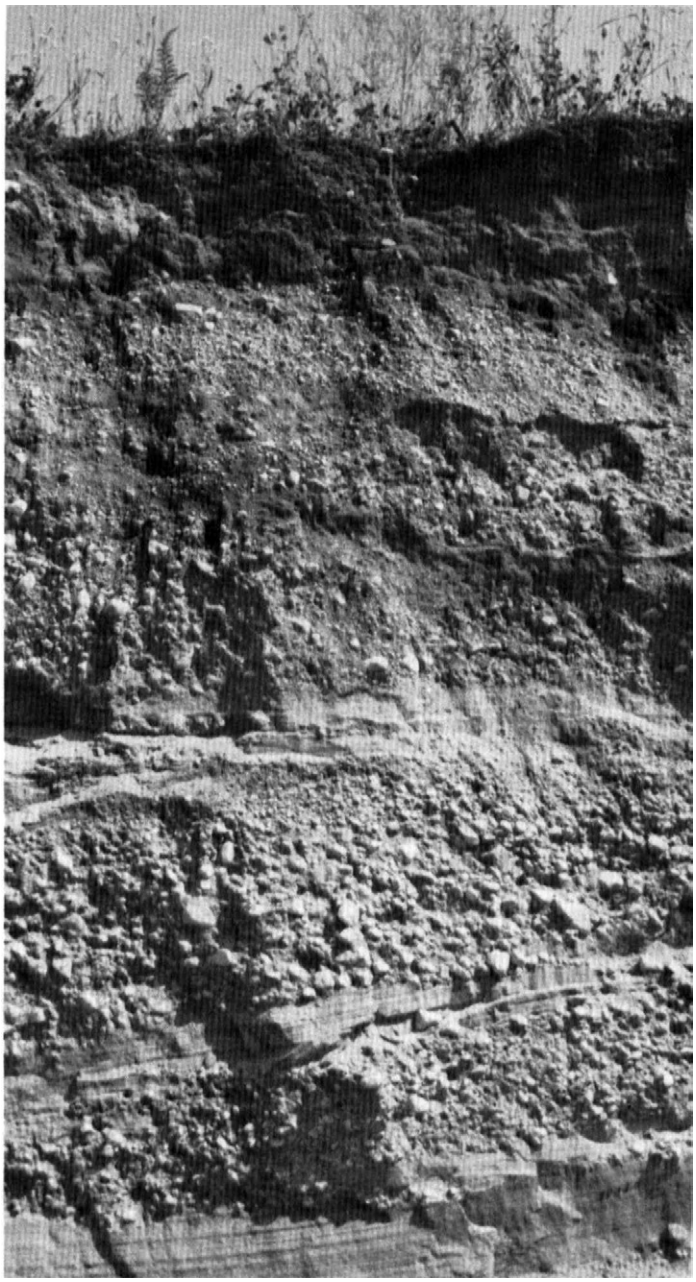

Figure 11.—A pit exposure in an area of Kiva soils. The substratum is a probable source of sand and gravel.

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 13, 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 14 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 for 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. 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 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, 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. 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. The performance of a system is affected by the depth of the root zone, the amount of salts, 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 soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts, 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. These results are reported in table 18.

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 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 12). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

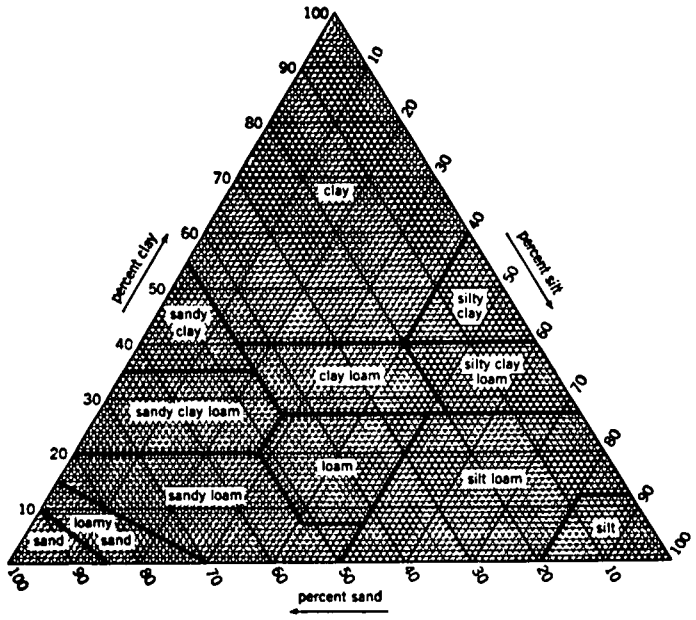

Figure 12.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in

group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to

buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

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

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

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

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 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.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 17 shows the expected total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Wisconsin Department of Transportation, Division of Highways and Transportation Facilities.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*10*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boralf (*Bor*, meaning cool, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Glossoboralfs (*Gloss*, meaning tongued, plus *boralf*, the suborder of the Alfisols that has a frigid temperature 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 Glossoboralfs.

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 Typic Glossoboralfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*8*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*10*). 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."

Alpena Series

The Alpena series consists of deep, excessively drained, very rapidly permeable soils on kames and eskers. These soils formed in about 10 inches of gravelly and loamy deposits underlain by stratified sand and very gravelly sand. Slope ranges from 20 to 35 percent.

Typical pedon of Alpena gravelly sandy loam, 20 to 35 percent slopes, 270 feet south and 600 feet east of the northwest corner of sec. 4, T. 29 N., R. 19 E.

A—0 to 4 inches; very dark gray (10YR 3/1) gravelly sandy loam, dark brown (10YR 4/3) dry; weak medium granular structure; very friable; common

roots; about 25 percent pebbles; neutral; clear smooth boundary.
Bw—4 to 8 inches; dark brown (10YR 4/3) very gravelly sandy loam; moderate medium subangular blocky structure; very friable; few roots; about 45 percent pebbles; neutral; clear wavy boundary.
2C—8 to 60 inches; brown (10YR 5/3) stratified sand and very gravelly sand; single grain; loose; about 50 percent pebbles and 10 percent cobbles; slightly effervescent; moderately alkaline.

The solum is 4 to 8 inches thick. The content of pebbles ranges from 15 to 35 percent in the A horizon and from 35 to 50 percent in the Bw and 2C horizons. The content of cobbles ranges from 0 to 10 percent in the 2C horizon.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has value of 3 or 4 and chroma of 2 to 6. It is sandy loam, loamy sand, or the gravelly or very gravelly analogs of these textures. The 2C horizon has value of 5 or 6 and chroma of 3 or 4.

Bonduel Series

The Bonduel series consists of moderately deep, somewhat poorly drained, moderately permeable soils on ground moraines. These soils formed in loamy till underlain by dolomite. Slope ranges from 0 to 3 percent.

Typical pedon of Bonduel loam, 0 to 3 percent slopes, 1,000 feet south and 700 feet east of the northwest corner of sec. 16, T. 26 N., R. 19 E.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; many roots; neutral; abrupt wavy boundary.
BE—8 to 14 inches; dark brown (7.5YR 4/4) loam; common medium prominent strong brown (7.5YR 5/8) and few fine distinct pinkish gray (7.5YR 6/2) mottles; weak medium subangular blocky structure; friable; many roots; mildly alkaline; gradual wavy boundary.
Bt1—14 to 20 inches; brown (7.5YR 5/4) loam; common medium distinct pinkish gray (7.5YR 6/2) and common medium prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; many roots; few distinct clay films on faces of peds; about 2 percent dolomitic pebbles; mildly alkaline; gradual wavy boundary.
Bt2—20 to 25 inches; brown (7.5YR 5/4) loam; common medium distinct pinkish gray (7.5YR 6/2) and common medium prominent strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; few faint clay films on faces of peds; about 5 percent dolomitic pebbles; mildly alkaline; clear irregular boundary.
C—25 to 37 inches; light brown (7.5YR 6/4) loam; common medium prominent strong brown (7.5YR 5/8) and few medium distinct pinkish gray (7.5YR 6/2) mottles; massive; about 5 percent dolomitic pebbles; friable; violently effervescent; mildly alkaline; abrupt wavy boundary.
R—37 inches; light gray (10YR 6/1) dolomite.

The thickness of the solum and the depth to dolomite range from 20 to 40 inches. The content of pebbles ranges from 0 to 5 percent in the upper part of the solum and from 5 to 15 percent in the lower part.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have an E horizon. The BE horizon has hue of 5YR, 7.5YR, or 10YR. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam, silt loam, clay loam, or sandy clay loam. Some pedons have a BC horizon. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. It is loam or sandy loam.

Brevort Series

The Brevort series consists of deep, poorly drained and very poorly drained soils on ground moraines and glacial lake plains. These soils formed in sandy mantle underlain by loamy till or loamy or silty lacustrine deposits. They are rapidly permeable in the upper part and moderately slowly permeable in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Brevort mucky loamy sand, 0 to 2 percent slopes, 2,350 feet west and 200 feet south of the northeast corner of sec. 1, T. 27 N., R. 20 E.

Ap—0 to 9 inches; black (10YR 2/1) mucky loamy sand, dark gray (10YR 4/1) dry; weak medium subangular structure; very friable; common roots; neutral; abrupt smooth boundary.
Cg1—9 to 35 inches; grayish brown (10YR 5/2) sand; common fine prominent strong brown (7.5YR 4/6) mottles; single grain; loose; few roots; neutral; clear wavy boundary.
Cg2—35 to 60 inches; brown (7.5YR 5/2) silt loam; few fine prominent strong brown (7.5YR 5/8) mottles; massive; friable; mildly alkaline.

The thickness of the sandy mantle ranges from 20 to 40 inches. The A horizon has value of 2 or 3. The Cg1 horizon has value of 4 to 6 and chroma of 1 to 4. It is sand, fine sand, loamy sand, or loamy fine sand. The Cg2 horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 2 to 4. It is loam, clay loam, silty clay loam, or silt loam.

Cormant Series

The Cormant series consists of deep, poorly drained and very poorly drained, rapidly permeable soils on outwash plains and glacial lake plains. These soils formed in sandy deposits. Slope is 0 to 1 percent.

Typical pedon of Cormant loamy fine sand, 0 to 1 percent slopes, 600 feet west and 60 feet north of the southeast corner of sec. 36, T. 28 N., R. 21 E.

A—0 to 9 inches; very dark gray (10YR 3/1) loamy fine sand, gray (10YR 5/1) dry; weak medium granular structure; friable; common roots; neutral; abrupt smooth boundary.
Cg1—9 to 18 inches; dark grayish brown (2.5Y 4/2) fine sand; common fine prominent yellowish red (5YR 4/6) mottles; single grain; loose; common roots; slightly acid; clear wavy boundary.
Cg2—18 to 35 inches; grayish brown (2.5Y 5/2) fine sand; common fine prominent strong brown (7.5YR 5/8) mottles; single grain; loose; slightly acid; clear wavy boundary.
Cg3—35 to 60 inches; grayish brown (2.5Y 5/2) fine sand; few fine prominent strong brown (7.5YR 5/8) mottles; single grain; loose; neutral.

Some pedons have an O surface horizon, which is as much as 4 inches thick. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Cg horizon has value of 4 or 5 and chroma of 1 or 2.

Ensley Series

The Ensley series consists of deep, poorly drained and very poorly drained soils on ground moraines. These soils formed in calcareous, loamy till. They are moderately permeable in the upper part and moderately rapidly permeable in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Ensley mucky loam, 0 to 2 percent slopes, 570 feet east and 390 feet north of the southwest corner of sec. 8, T. 28 N., R. 19 E.

Ap—0 to 7 inches; black (10YR 2/1) mucky loam, very dark gray (10YR 3/1) dry; weak fine granular structure; about 5 percent pebbles; friable; many roots; neutral; abrupt smooth boundary.
EB—7 to 12 inches; grayish brown (2.5Y 5/2) silt loam; common fine prominent reddish yellow (7.5YR 6/6) mottles; weak thin platy structure; friable; about 5 percent pebbles; many roots; neutral; abrupt wavy boundary.
Bw1—12 to 16 inches; dark brown (7.5YR 4/4) sandy loam; many medium distinct yellowish red (5YR 4/6) and few fine distinct reddish gray (5YR 5/2) mottles; moderate thick platy structure; firm; about 5 percent pebbles; common roots; neutral; gradual wavy boundary.
Bw2—16 to 23 inches; reddish brown (5YR 5/3) sandy loam; many medium faint reddish brown (5YR 4/4) and common medium prominent red (2.5YR 4/6) mottles; moderate coarse subangular blocky structure; firm; about 5 percent pebbles; few roots; mildly alkaline; gradual wavy boundary.
Bw3—23 to 27 inches; reddish brown (5YR 4/4) sandy loam; common medium prominent yellowish red (5YR 5/8) and few fine distinct brown (7.5YR 5/2) mottles; moderate medium subangular blocky structure; firm; about 5 percent pebbles; mildly alkaline; gradual wavy boundary.
C1—27 to 30 inches; brown (7.5YR 5/4) sandy loam; many medium prominent strong brown (7.5YR 5/8) mottles; massive; friable; about 5 percent pebbles; mildly alkaline; clear wavy boundary.
C2—30 to 60 inches; reddish brown (5YR 5/3) sandy loam; common fine prominent yellowish red (5YR 4/6) mottles; massive; friable; about 5 percent pebbles; mildly alkaline.

The thickness of the solum ranges from 18 to 27 inches. The content of pebbles ranges from 1 to 10 percent throughout the profile.

The A horizon has chroma of 1 or 2. The EB horizon has hue of 10YR or 2.5Y and value of 4 or 5. The Bw1 and Bw2 horizons are loam or sandy loam. The Bw1 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The Bw2 horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. Some pedons do not have a Bw3 horizon. The C horizon has hue of 7.5YR or 5YR and chroma of 2 to 4.

Fairport Series

The Fairport series consists of moderately deep, well drained, moderately permeable soils on ground moraines. These soils formed in loamy till underlain by dolomite. Slope ranges from 2 to 12 percent.

These soils are taxadjuncts to the Fairport series because they have tongues of soil material from the E horizon that extend into the Bt horizon. This difference, however, does not affect the usefulness or behavior of the soils.

Typical pedon of Fairport fine sandy loam, 6 to 12 percent slopes, 2,100 feet east and 1,570 feet north of the southwest corner of sec. 35, T. 29 N., R. 18 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; few roots; few pebbles; mildly alkaline; abrupt smooth boundary.
E/B—8 to 14 inches; about 70 percent tongues of brown (10YR 5/3) fine sandy loam (E), light gray (10YR 7/2) dry; weak thin platy structure; friable; dark reddish brown (5YR 3/4) loam (Bt); moderate medium subangular blocky structure; friable; few pebbles; mildly alkaline; clear wavy boundary.
Bt—14 to 26 inches; dark reddish brown (5YR 3/4) loam; moderate medium subangular blocky structure; firm; few distinct clay films on vertical

faces of peds; mildly alkaline; gradual wavy boundary.
BC—26 to 34 inches; reddish brown (5YR 5/4) sandy loam; moderate medium subangular blocky structure; friable; mildly alkaline; abrupt smooth boundary.
R—34 inches; dolomite.

The thickness of the solum and the depth to dolomite range from 20 to 40 inches. The content of pebbles ranges from 0 to 10 percent throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR. Some pedons have an E horizon. These soils have an E/B horizon or a B/E horizon, or both. The E part has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. The B part has colors and textures similar to those of the Bt horizon. The Bt horizon has value of 3 or 4. It is clay loam, loam, or sandy clay loam. The BC horizon has value of 4 or 5 and chroma of 4 to 6. It is loam or sandy loam. Some pedons have a C horizon, which has colors and textures similar to those of the BC horizon.

Fence Series

The Fence series consists of deep, well drained, moderately slowly permeable soils on glacial lake plains. These soils formed in loamy glaciolacustrine deposits. Slope ranges from 2 to 12 percent.

Typical pedon of Fence very fine sandy loam, 2 to 6 percent slopes, 2,390 feet south and 1,320 feet east of the northwest corner of sec. 23, T. 26 N., R. 20 E.

Ap—0 to 7 inches; dark brown (10YR 3/3) very fine sandy loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; common roots; slightly acid; abrupt smooth boundary.
Bs—7 to 11 inches; brown (7.5YR 4/4) very fine sandy loam; moderate medium subangular blocky structure; friable; common roots; slightly acid; clear wavy boundary.
E—11 to 13 inches; brown (7.5YR 5/2) very fine sandy loam, pinkish gray (7.5YR 7/2) dry; moderate medium subangular blocky structure; friable; common roots; slightly acid; clear wavy boundary.
E/B—13 to 19 inches; about 60 percent tongues of brown (7.5YR 5/2) very fine sandy loam (E), pinkish gray (7.5YR 7/2) dry; reddish brown (5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; friable; few roots; slightly acid; clear wavy boundary.
Bt—19 to 33 inches; reddish brown (5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few faint clay bridges between mineral grains; few roots; slightly acid; clear wavy boundary.
C—33 to 60 inches; brown (7.5YR 5/4) stratified silt and very fine sand; massive; very friable; medium acid.

The thickness of the solum ranges from 28 to 39 inches. The Ap horizon has hue of 7.5YR or 10YR and chroma of 2 or 3. The Bs and E horizons are very fine sandy loam or silt loam. The Bs horizon has value of 4 or 5 and chroma of 3 or 4. The E horizon has value of 5 or 6 and chroma of 2 to 4. These soils have an E/B horizon or a B/E horizon, or both. These horizons have colors and textures similar to those of the E and Bt horizons. The Bt horizon has hue of 5YR or 7.5YR and chroma of 4 to 6. It is very fine sandy loam or silt loam. The C horizon has value of 4 or 5 and chroma of 3 to 6. It is silt, silt loam, or very fine sand and is commonly stratified.

Iosco Series

The Iosco series consists of deep, somewhat poorly drained soils on ground moraines and glacial lake plains. These soils formed in a sandy mantle and in the underlying loamy deposits. They are rapidly permeable in the upper part and moderately permeable in the lower part. Slope ranges from 0 to 3 percent.

Typical pedon of Iosco loamy fine sand, 0 to 3 percent slopes, 1,600 feet south and 1,400 feet east of the northwest corner of sec. 20, T. 27 N., R. 20 E.

Ap—0 to 10 inches; very dark brown (10YR 2/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common roots; slightly acid; abrupt smooth boundary.
Bs—10 to 23 inches; dark brown (7.5YR 4/4) loamy fine sand; few fine faint strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very friable; few roots; neutral; abrupt wavy boundary.
2Bt—23 to 34 inches; brown (7.5YR 4/4) loam; common medium prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; few roots; few faint clay films on faces of peds; mildly alkaline; clear wavy boundary.
2C—34 to 60 inches; reddish brown (5YR 5/4) sandy loam; common medium prominent strong brown (7.5YR 5/8) mottles; massive; friable; strongly effervescent; moderately alkaline.

The thickness of the sandy mantle ranges from 20 to 40 inches. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have an E horizon. This horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 or 2. It is loamy sand, sand, fine sand, or loamy fine sand. The Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 4 to 6. It is fine sand, sand, or loamy fine sand. Some pedons have an E horizon below the Bs horizon. This E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3. It is sand, loamy sand, or fine sand.

The 2Bt horizon has hue of 5YR or 7.5YR and value and chroma of 4 or 5. It is loam, sandy clay loam, or fine sandy loam. The 2C horizon has hue of 5YR, 7.5YR, or

10YR, value of 4 or 5, and chroma of 2 to 4. It is loam or sandy loam.

Kennan Series

The Kennan series consists of deep, well drained soils on ground moraines and end moraines. These soils formed in sandy loam or loamy sand till. They are moderately permeable in the upper part and moderately rapidly permeable in the lower part. Slope ranges from 2 to 30 percent.

These soils are taxadjuncts because the color of the tongues of E material that extend into the Bt horizon does not meet all of the requirements specified for the Kennan series. This difference, however, does not affect the usefulness or behavior of the soils.

Typical pedon of Kennan fine sandy loam, 6 to 15 percent slopes, 100 feet east and 50 feet south of the northwest corner of sec. 31, T. 30 N., R. 17 E.

A—0 to 3 inches; black (10YR 2/1) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; about 5 percent pebbles; common roots; medium acid; abrupt smooth boundary.

E—3 to 5 inches; brown (10YR 4/3) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium platy structure; friable; about 5 percent pebbles; common roots; medium acid; abrupt wavy boundary.

Bs—5 to 14 inches; dark brown (7.5YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; about 5 percent pebbles; few roots; slightly acid; abrupt wavy boundary.

E/B—14 to 19 inches; about 70 percent tongues of brown (7.5YR 5/4) fine sandy loam (E); weak medium subangular blocky structure; friable; dark brown (7.5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; about 5 percent pebbles; few roots; slightly acid; clear wavy boundary.

B/E—19 to 35 inches; about 60 percent dark brown (7.5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few faint clay bridges between mineral grains; tongues of brown (7.5YR 5/4) fine sandy loam (E); about 10 percent pebbles; few roots; slightly acid; clear wavy boundary.

Bt—35 to 48 inches; reddish brown (5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few distinct clay bridges between mineral grains; about 10 percent pebbles; slightly acid; clear wavy boundary.

C—48 to 60 inches; reddish brown (5YR 4/4) sandy loam; massive; friable; about 10 percent pebbles; slightly acid.

The thickness of the solum ranges from 35 to 50 inches. The content of pebbles ranges from 5 to 15 percent throughout the profile, and the content of cobbles ranges from 0 to 10 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 7.5YR or 10YR and chroma of 2 or 3. It is sandy loam, fine sandy loam, or loamy sand. The Bs horizon has value and chroma of 3 or 4. These soils have an E/B horizon or a B/E horizon, or both. The E part has value of 4 to 6 and chroma of 2 to 4. The Bt part has hue of 5YR or 7.5YR and value of 4 or 5. The Bt horizon has chroma of 3 to 5. The C horizon has hue of 5YR or 7.5YR. It is sandy loam or loamy sand.

Keweenaw Series

The Keweenaw series consists of deep, well drained, moderately permeable and moderately rapidly permeable soils on end moraines and ground moraines. These soils formed in sandy and loamy drift. Slope ranges from 2 to 35 percent.

Typical pedon of Keweenaw loamy fine sand, 2 to 6 percent slopes, 2,600 feet east and 390 feet south of the northwest corner of sec. 4, T. 32 N., R. 17 E.

A—0 to 3 inches; dark brown (7.5YR 3/2) loamy fine sand, brown (7.5YR 4/2) dry; weak fine granular structure; very friable; many roots; medium acid; abrupt smooth boundary.

Bhs—3 to 9 inches; dark reddish brown (5YR 3/3) loamy fine sand; weak fine subangular blocky structure; very friable; common roots; medium acid; clear wavy boundary.

Bs1—9 to 15 inches; reddish brown (5YR 4/4) loamy fine sand; weak medium subangular blocky structure; very friable; common roots; medium acid; gradual wavy boundary.

Bs2—15 to 27 inches; strong brown (7.5YR 4/6) loamy fine sand; weak coarse subangular blocky structure; very friable; few roots; medium acid; clear wavy boundary.

Bs3—27 to 34 inches; brown (7.5YR 4/4) loamy fine sand; weak coarse subangular blocky structure; very friable; about 10 percent pebbles; medium acid; gradual wavy boundary.

B/E—34 to 50 inches; about 60 percent pockets of reddish brown (5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few faint clay bridges between mineral grains; brown (7.5YR 5/4) loamy fine sand (E), light brown (7.5YR 6/4) dry; weak medium subangular blocky structure; very friable; about 10 percent pebbles; medium acid; clear wavy boundary.

C—50 to 60 inches; brown (7.5YR 5/4) loamy sand; massive; very friable; about 10 percent pebbles; medium acid.

The thickness of the solum ranges from 30 to 50 inches. The content of cobbles ranges from 0 to 15 percent in the substratum.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an E horizon. This horizon has hue of 5YR or 7.5YR and value of 5 or 6. The E, Bhs, and Bs horizons and the E part of the B/E horizon are loamy sand or loamy fine sand. Some pedons do not have a Bhs horizon. The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 4 to 6. The E part of the B/E horizon has value of 5 or 6 and chroma of 2 to 4. The Bt part has value of 3 or 4 and chroma of 4 to 6. It is sandy loam or fine sandy loam. Some pedons do not have a B/E horizon but have separate E and Bt horizons. The C horizon has hue of 5YR or 7.5YR and value and chroma of 4 to 6.

Kiva Series

The Kiva series consists of deep, well drained soils on outwash plains, eskers, ground moraines, and end moraines. These soils formed in loamy deposits underlain by calcareous sand and gravel. They are moderately permeable in the upper part and very rapidly permeable in the lower part. Slope ranges from 2 to 35 percent.

Typical pedon of Kiva sandy loam, 2 to 6 percent slopes, 1,960 feet east and 20 feet south of the northwest corner of sec. 36, T. 28 N., R. 17 E.

Ap—0 to 10 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many roots; about 10 percent pebbles; neutral; abrupt smooth boundary.

Bs—10 to 15 inches; reddish brown (5YR 4/4) sandy loam; weak fine subangular blocky structure; friable; common roots; about 10 percent pebbles; mildly alkaline; clear wavy boundary.

2C1—15 to 20 inches; brown (7.5YR 4/4) gravelly sand; single grain; loose; few roots; about 30 percent pebbles; moderately alkaline; clear wavy boundary.

2C2—20 to 60 inches; yellowish brown (10YR 5/4) very gravelly sand; single grain; loose; about 40 percent pebbles; moderately alkaline.

The thickness of the solum and of the loamy mantle ranges from 10 to 24 inches. The content of pebbles ranges from 5 to 20 percent in the solum and from 15 to 20 percent in the substratum. The content of cobbles ranges from 0 to 5 percent in the solum and from 0 to 20 percent in the substratum.

The Ap horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. Most undisturbed pedons have an E horizon. The Bs horizon has hue of 7.5YR or 5YR and value and chroma of 3 or 4. It is sandy loam, loam, or the gravelly analogs of these textures. The 2C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is gravelly sand, very gravelly sand, or coarse sand and is commonly stratified.

Loxley Series

The Loxley series consists of deep, very poorly drained, moderately rapidly permeable soils on ground moraines and outwash plains. These soils formed in organic material derived from herbaceous plants. Slope is 0 to 1 percent.

Typical pedon of Loxley mucky peat, 0 to 1 percent slopes, 650 feet east and 1,650 feet north of the southwest corner of sec. 32, T. 29 N., R. 18 E.

Oe—0 to 6 inches; dark reddish brown (5YR 2/2), broken face and rubbed, hemic material; about 70 percent fibers, 25 percent rubbed; weak thick platy structure; very friable; many roots; few partly decomposed woody stems; extremely acid (pH 4.0 in water); abrupt smooth boundary.

Oa1—6 to 23 inches; dark reddish brown (5YR 2/2), broken face and rubbed, sapric material; about 50 percent fibers, 5 percent rubbed; moderate medium subangular blocky structure; friable; few roots; few partly decomposed woody stems; extremely acid (pH 4.0 in water); clear wavy boundary.

Oa2—23 to 37 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 25 percent fibers, 5 percent rubbed; weak thick platy structure; friable; few partly decomposed woody stems; extremely acid (pH 4.0 in water); clear wavy boundary.

Oa3—37 to 60 inches; very dark brown (10YR 2/2), broken face and rubbed, sapric material; about 40 percent fibers, 5 percent rubbed; weak thick platy structure; friable; few partly decomposed woody stems; extremely acid (pH 4.0 in water).

The organic material is more than 51 inches thick. It has hue of 5YR, 7.5YR, or 10YR, value of 2 to 4, and chroma of 1 or 2. The surface tier is dominantly sapric or hemic material, but as much as 10 inches of fibric material covers the surface in some pedons.

Mancelona Series

The Mancelona series consists of deep, somewhat excessively drained soils on outwash plains. These soils formed in sandy and loamy deposits over sand and gravel. They are moderately rapidly permeable in the upper part and very rapidly permeable in the lower part. Slope ranges from 1 to 15 percent.

Typical pedon of Mancelona loamy sand, 1 to 6 percent slopes, 1,000 feet west and 130 feet north of the southeast corner of sec. 20, T. 29 N., R. 18 E.

Ap—0 to 9 inches; dark brown (7.5YR 3/2) loamy sand, brown (7.5YR 4/2) dry; weak fine granular structure;

very friable; common roots; about 3 percent pebbles; neutral; abrupt smooth boundary.
Bs1—9 to 14 inches; strong brown (7.5YR 4/6) sand; weak medium subangular blocky structure; very friable; few roots; about 3 percent pebbles; mildly alkaline; gradual wavy boundary.
Bs2—14 to 26 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; few roots; about 3 percent pebbles; mildly alkaline; abrupt wavy boundary.
Bt—26 to 30 inches; dark brown (7.5YR 3/4) sandy clay loam; moderate medium subangular blocky structure; firm; common distinct clay bridges between mineral grains; few roots; about 10 percent pebbles; mildly alkaline; abrupt wavy boundary.
2C—30 to 60 inches; dark yellowish brown (10YR 4/4) very gravelly sand; single grain; loose; about 45 percent pebbles; slightly effervescent; mildly alkaline.

The thickness of the solum ranges from 28 to 36 inches. The content of pebbles ranges from 15 to 50 percent in the substratum.

The Ap horizon has hue of 7.5YR or 10YR and chroma of 2 or 3. Some pedons have an E horizon. The Bs horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The Bt horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is sandy loam or sandy clay loam. The 2C horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is very gravelly sand or gravelly sand.

Markey Series

The Markey series consists of deep, very poorly drained soils on outwash plains. These soils formed in organic material derived primarily from herbaceous plants and are underlain by sandy material. They are moderately permeable in the upper part and rapidly permeable in the lower part. Slope is 0 to 1 percent.

Typical pedon of Markey muck, in an area of Seelyeville and Markey mucks, 0 to 1 percent slopes, 2,000 feet north and 50 feet east of the southwest corner of sec. 25, T. 30 N., R. 19 E.

Oa1—0 to 7 inches; black (N 2/0), broken face and rubbed, sapric material; about 7 percent fibers, less than 5 percent rubbed; weak fine granular structure; very friable; common roots; primarily herbaceous fibers; neutral (pH 7.0 in water); abrupt smooth boundary.
Oa2—7 to 21 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 10 percent fibers, less than 5 percent rubbed; weak thin platy structure; very friable; few roots; primarily herbaceous fibers; neutral (pH 7.0 in water); clear smooth boundary.
Oa3—21 to 29 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 20 percent fibers, less than 5 percent rubbed; weak thin platy structure; friable; primarily herbaceous fibers; about 5 percent mineral soil material; neutral (pH 7.2 in water); clear smooth boundary.
Oa4—29 to 32 inches; very dark brown (10YR 2/2), broken face and rubbed, sapric material; about 20 percent fibers, less than 5 percent rubbed; moderate thick platy structure; friable; primarily herbaceous fibers; about 1 percent mineral soil material; neutral (pH 7.3 in water); clear smooth boundary.
Oa5—32 to 37 inches; black (N 2/0), broken face and rubbed, sapric material; about 10 percent fibers, less than 5 percent rubbed; massive; primarily herbaceous fibers; about 10 percent mineral soil material; mildly alkaline (pH 7.5 in water); abrupt smooth boundary.
C—37 to 60 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; mildly alkaline (pH 7.5 in water).

The organic material ranges from 16 to 51 inches in thickness. It is dominantly sapric material, but some pedons have as much as 10 inches of hemic material in the subsurface tier. The content of woody fragments ranges from 0 to 15 percent throughout the organic material. The C horizon has value of 4 to 6 and chroma of 1 or 2. It is sand, loamy sand, or gravelly sand.

Menahga Series

The Menahga series consists of deep, excessively drained, rapidly permeable soils on outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 35 percent.

Typical pedon of Menahga sand, 0 to 6 percent slopes, 2,500 feet west and 1,500 feet north of the southeast corner of sec. 14, T. 32 N., R. 17 E.

A—0 to 3 inches; black (10YR 2/1) sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.
AB—3 to 5 inches; very dark grayish brown (10YR 3/2) sand, brown (10YR 4/3) dry; weak fine subangular blocky structure; very friable; many roots; strongly acid; abrupt wavy boundary.
Bw—5 to 20 inches; strong brown (7.5YR 4/6) sand; weak fine subangular blocky structure; very friable; few roots; about 5 percent pebbles; medium acid; gradual wavy boundary.
BC—20 to 34 inches; dark yellowish brown (10YR 4/6) sand; single grain; loose; about 5 percent pebbles; medium acid; clear wavy boundary.
C—34 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 5 percent pebbles; neutral.

The thickness of the solum ranges from 20 to 40 inches. The content of pebbles ranges from 0 to 15 percent throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is dominantly sand, but some pedons are loamy sand to a depth of about 10 inches. The BC horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The C horizon has hue of 7.5YR or 10YR and value of 5 or 6.

Menominee Series

The Menominee series consists of deep, well drained soils on ground moraines, outwash plains, and glacial lake plains. These soils formed in a sandy mantle and in the underlying loamy deposits. They are rapidly permeable in the upper part and moderately permeable in the lower part. Slope ranges from 2 to 20 percent.

Typical pedon of Menominee loamy fine sand, 2 to 6 percent slopes, 2,300 feet north and 60 feet east of the southwest corner of sec. 13, T. 29 N., R. 19 E.

Ap—0 to 9 inches; dark brown (7.5YR 3/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common roots; slightly acid; abrupt smooth boundary.

Bs1—9 to 14 inches; strong brown (7.5YR 5/6) fine sand; weak fine subangular blocky structure; very friable; few roots; slightly acid; clear wavy boundary.

Bs2—14 to 17 inches; strong brown (7.5YR 4/6) fine sand; weak medium subangular blocky structure; very friable; few roots; slightly acid; abrupt wavy boundary.

E—17 to 23 inches; brown (10YR 4/3) loamy fine sand, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; very friable; few roots; about 3 percent pebbles; slightly acid; abrupt wavy boundary.

2Bt—23 to 29 inches; dark reddish brown (5YR 3/4) clay loam; strong medium subangular blocky structure; firm; few distinct clay films on faces of peds; about 7 percent pebbles; neutral; clear wavy boundary.

2C—29 to 60 inches; brown (7.5YR 5/4) sandy loam; massive; friable; about 10 percent pebbles; mildly alkaline.

The thickness of the sandy mantle ranges from 20 to 40 inches. The A horizon has hue of 10YR or 7.5YR and chroma of 2 or 3. Some pedons have an E horizon below the A horizon. The Bs horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loamy sand, loamy fine sand, fine sand, or sand. The E horizon below the Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 2 or 3. It is loamy sand or loamy fine sand. The 2Bt horizon has value of 3 or 4. It is sandy loam, loam, or clay loam. The 2C horizon has hue of 7.5YR or 5YR. It is loam or sandy loam.

Minocqua Series

The Minocqua series consists of deep, poorly drained and very poorly drained soils on outwash plains. These soils formed in loamy deposits underlain by sand. They are moderately permeable in the upper part and rapidly permeable or very rapidly permeable in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Minocqua mucky fine sandy loam, 0 to 2 percent slopes, 2,150 feet west and 925 feet north of the southeast corner of sec. 26, T. 31 N., R. 15 E.

Oa—0 to 4 inches; black (10YR 2/1) muck; moderate medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

Eg—4 to 10 inches; dark gray (10YR 4/1) fine sandy loam, light gray (10YR 7/1) dry; weak medium subangular blocky structure; friable; few roots; mildly alkaline; clear wavy boundary.

Bg1—10 to 25 inches; light gray (5YR 6/1) fine sandy loam; few medium prominent light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; friable; mildly alkaline; clear wavy boundary.

Bg2—25 to 36 inches; gray (5Y 5/1) fine sandy loam; common medium prominent light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; friable; mildly alkaline; abrupt wavy boundary.

2Cg—36 to 60 inches; grayish brown (10YR 5/2) sand; single grain; loose; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The content of pebbles ranges from 0 to 15 percent in the solum and from 0 to 30 percent in the substratum. The content of cobbles ranges from 0 to 5 percent throughout the profile.

The Oa horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have an A horizon. The Eg horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 or 2. The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 or 2. It is fine sandy loam or loam. The 2C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It is sand or gravelly sand.

Nester Series

The Nester series consists of deep, well drained, moderately slowly permeable soils on ground moraines. These soils formed in a thin silty mantle underlain by loamy or silty till. Slope ranges from 1 to 6 percent.

Typical pedon of Nester silt loam, 1 to 6 percent slopes, 2,500 feet south and 1,340 feet west of the northeast corner of sec. 10, T. 29 N., R. 19 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; strong

fine subangular blocky structure; firm; neutral; abrupt smooth boundary.

B/E—9 to 12 inches; about 70 percent reddish brown (5YR 4/4) clay (Bt); strong coarse subangular blocky structure; very firm; common faint clay films on faces of peds; interfingering of brown (7.5YR 5/2) silt loam (E), pinkish gray (7.5YR 7/2) dry; neutral; clear smooth boundary.

Bt—12 to 24 inches; reddish brown (5YR 4/4) clay; strong coarse subangular blocky structure; very firm; common faint clay films on faces of peds; neutral; gradual wavy boundary.

C—24 to 60 inches; reddish brown (5YR 5/4) silty clay loam; massive; very firm; about 5 percent pebbles; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 20 to 36 inches. The Ap horizon has value of 3 or 4 and chroma of 1 or 2. Some pedons have an E horizon. This horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2. It is loam, silt loam, or sandy loam. The B/E horizon has colors and textures similar to those of the E and Bt horizons. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is clay, silty clay, clay loam, or silty clay loam. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is clay loam or silty clay loam.

Oconto Series

The Oconto series consists of deep, well drained soils on outwash plains. These soils formed in loamy deposits underlain by calcareous sand and gravel. They are moderately permeable in the upper part and rapidly permeable or very rapidly permeable in the lower part. Slope ranges from 2 to 20 percent.

Typical pedon of Oconto fine sandy loam, 2 to 6 percent slopes, 2,490 feet south and 30 feet east of the northwest corner of sec. 28, T. 29 N., R. 17 E.

Ap—0 to 9 inches; dark brown (7.5YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common roots; about 5 percent pebbles; mildly alkaline; clear smooth boundary.

Bs—9 to 14 inches; brown (7.5YR 4/4) fine sandy loam; weak fine subangular blocky structure; very friable; common roots; about 5 percent pebbles; mildly alkaline; clear wavy boundary.

E—14 to 16 inches; brown (10YR 5/3) fine sandy loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; very friable; common roots; about 5 percent pebbles; mildly alkaline; clear wavy boundary.

B/E—16 to 22 inches; about 60 percent reddish brown (5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure; friable; few faint clay bridges between mineral grains; interfingering of brown (10YR 5/3) fine sandy loam (E), very pale brown (10YR 7/3) dry; common roots; about 5 percent pebbles; neutral; clear irregular boundary.

Bt—22 to 33 inches; reddish brown (5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common distinct clay bridges between mineral grains; common roots; about 5 percent pebbles; neutral; clear wavy boundary.

2C—33 to 60 inches; strong brown (7.5YR 4/6) sand; single grain; loose; about 10 percent pebbles; few strong brown (7.5YR 4/6) loamy sand strata 1/8 inch thick; mildly alkaline.

The thickness of the solum and of the loamy mantle ranges from 24 to 40 inches. The content of pebbles ranges from 0 to 15 percent in the solum and from 5 to 35 percent in the substratum.

The Ap or A horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 or 2. Some pedons have an E horizon below the A horizon. The Bs horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is fine sandy loam, sandy loam, or loam. The E horizon below the Bs horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. It is fine sandy loam, sandy loam, or loam. Some pedons do not have this E horizon. Some have an E/B horizon or a B/E horizon, or both. These horizons have textures and colors similar to those of the E and Bt horizons. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, fine sandy loam, or sandy loam.

The 2C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sand, gravelly sand, or stratified sand and gravel.

Onaway Series

The Onaway series consists of deep, well drained and moderately well drained soils on ground moraines and end moraines. These soils formed in calcareous, loamy till. Permeability generally is moderate or moderately slow throughout the profile. It is rapid, however, in the substratum of the sandy substratum phase. Slope ranges from 1 to 35 percent.

These soils have a darker Ap horizon than is definitive for the Onaway series. This difference, however, does not affect the usefulness or behavior of the soils.

Typical pedon of Onaway fine sandy loam, 1 to 6 percent slopes, 2,600 feet east and 25 feet north of the southwest corner of sec. 8, T. 29 N., R. 21 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many roots; about 5 percent pebbles; mildly alkaline; abrupt smooth boundary.

E—8 to 14 inches; brown (7.5YR 5/2) fine sandy loam, pinkish gray (7.5YR 7/2) dry; weak medium granular structure; very friable; common roots; about 5

percent pebbles; mildly alkaline; clear wavy boundary.

B/E—14 to 18 inches; about 70 percent reddish brown (5YR 4/4) loam (Bt); moderate medium subangular blocky structure; friable; few faint clay films on faces of peds; interfingering of brown (7.5YR 5/2) fine sandy loam (E), pinkish gray (7.5YR 7/2) dry; common roots; about 5 percent pebbles; mildly alkaline; clear wavy boundary.

Bt—18 to 25 inches; reddish brown (5YR 4/4) loam; moderate medium subangular blocky structure; friable; few faint clay films on faces of peds; common roots; about 5 percent pebbles; mildly alkaline; clear wavy boundary.

C1—25 to 38 inches; brown (7.5YR 4/4) sandy loam; massive; friable; about 10 percent pebbles and 3 percent cobbles; strongly effervescent; mildly alkaline; gradual wavy boundary.

C2—38 to 60 inches; brown (7.5YR 5/4) sandy loam; massive; friable; about 10 percent pebbles and 3 percent cobbles; strongly effervescent; mildly alkaline.

The thickness of the solum ranges from 15 to 30 inches. The content of cobbles ranges from 0 to 10 percent throughout the profile.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have a Bs horizon. The E horizon has value of 5 or 6. It is fine sandy loam or sandy loam. Some eroded pedons do not have an E horizon. The B/E horizon has colors and textures similar to those of the E and Bt horizons. Some pedons do not have a B/E horizon. The Bt horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. It is loam or clay loam. The 2BC horizon in the sandy substratum phase has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is loamy fine sand or loamy sand.

The C horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam or sandy loam. The 2C horizon in the sandy substratum phase has value of 5 or 6 and chroma of 4 to 8. It is loamy fine sand, fine sand, or sand and gravel.

Padus Series

The Padus series consists of deep, well drained soils on outwash plains. These soils formed in loamy and sandy deposits underlain by noncalcareous sand and gravel. They are moderately permeable in the upper part and rapidly permeable or very rapidly permeable in the lower part. Slope ranges from 1 to 35 percent.

Typical pedon of Padus fine sandy loam, 1 to 6 percent slopes, 2,400 feet east and 1,450 feet south of the northwest corner of sec. 14, T. 32 N., R. 16 E.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; many roots; medium acid; abrupt wavy boundary.

Bs—3 to 11 inches; brown (7.5YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; many roots; strongly acid; clear wavy boundary.

E/B—11 to 17 inches; about 70 percent brown (7.5YR 5/4) fine sandy loam (E), light brown (7.5YR 6/4) dry; moderate medium subangular blocky structure; friable; isolated remnants of reddish brown (5YR 4/4) loam (Bt); moderate fine subangular blocky structure; friable; few faint clay films on faces of peds; many roots; about 5 percent pebbles; strongly acid; abrupt wavy boundary.

Bt1—17 to 26 inches; reddish brown (5YR 4/4) loam; moderate medium subangular blocky structure; friable; few faint clay films on faces of peds; common roots; about 10 percent pebbles; strongly acid; clear wavy boundary.

2Bt2—26 to 31 inches; dark reddish brown (5YR 3/4) gravelly loamy sand; weak fine subangular blocky structure; very friable; few faint clay bridges between mineral grains; common roots; about 20 percent pebbles; medium acid; abrupt wavy boundary.

2C1—31 to 48 inches; strong brown (7.5YR 4/6) sand; single grain; loose; about 5 percent pebbles; slightly acid; abrupt wavy boundary.

2C2—48 to 60 inches; dark brown (7.5YR 4/4) gravelly coarse sand; single grain; loose; about 25 percent pebbles; slightly acid.

The thickness of the solum and of the loamy mantle ranges from 24 to 40 inches. The content of pebbles ranges from 0 to 10 percent in the upper part of the solum, from 5 to 30 percent in the 2Bt2 horizon, and from 15 to 40 percent in the substratum. The content of cobbles ranges from 0 to 5 percent throughout the profile.

The A horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have an E horizon below the A horizon. The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is fine sandy loam, sandy loam, or silt loam. Some pedons have an E horizon below the Bs horizon. These soils have an E/B horizon or a B/E horizon, or both. The E part has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is fine sandy loam, sandy loam, or silt loam. The B part has colors and textures similar to those of the Bt horizon. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam or sandy loam.

The 2Bt2 horizon has hue of 5YR or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is loamy sand, sandy loam, or the gravelly analogs of these textures. Some pedons do not have a 2Bt2 horizon. Some have a 2BC horizon. The 2C horizon has hue of 5YR or 7.5YR and value and chroma of 4 to 6. It is sand, coarse sand, or the gravelly or very gravelly analogs of these textures.

Pelkie Series

The Pelkie series consists of deep, moderately well drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. Slope ranges from 1 to 3 percent.

Typical pedon of Pelkie loamy fine sand, 1 to 3 percent slopes, 330 feet west and 725 feet north of the southeast corner of sec. 1, T. 29 N., R. 17 E.

A—0 to 2 inches; dark brown (7.5YR 3/2) loamy fine sand, brown (7.5YR 4/2) dry; weak fine granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.
C1—2 to 5 inches; brown (7.5YR 4/4) loamy fine sand; weak fine subangular blocky structure; very friable; many roots; very strongly acid; clear wavy boundary.
C2—5 to 21 inches; strong brown (7.5YR 4/6) fine sand; single grain; loose; common roots; very strongly acid; gradual wavy boundary.
C3—21 to 34 inches; brown (7.5YR 4/4) fine sand; common fine distinct yellowish red (5YR 4/6) mottles; single grain; loose; few roots; very strongly acid; gradual wavy boundary.
C4—34 to 60 inches; brown (7.5YR 4/4) sand; common fine distinct yellowish red (5YR 4/6) mottles; single grain; loose; very strongly acid.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. The C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 3 to 6. It is loamy fine sand, fine sand, or sand. Thin strata of sandy loam or loam are below a depth of 40 inches in some pedons.

Pence Series

The Pence series consists of deep, well drained soils on outwash plains, eskers, and stream terraces. These soils formed in loamy and sandy deposits underlain by sand and gravel. They are moderately rapidly permeable in the upper part and rapidly permeable or very rapidly permeable in the lower part. Slope ranges from 1 to 35 percent.

Typical pedon of Pence sandy loam, 1 to 6 percent slopes, 560 feet east and 2,640 feet south of the northwest corner of sec. 5, T. 33 N., R. 17 E.

A—0 to 1 inch; black (N 2/0) sandy loam, very dark gray (N 3/0) dry; weak fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.
E—1 to 2 inches; brown (7.5YR 4/2) sandy loam, brown (7.5YR 5/2) dry; weak fine subangular blocky structure; friable; many roots; about 10 percent pebbles; strongly acid; abrupt smooth boundary.
Bs1—2 to 11 inches; dark brown (7.5YR 3/4) sandy loam; weak fine subangular blocky structure; friable; common roots; about 10 percent pebbles; strongly acid; clear wavy boundary.
Bs2—11 to 18 inches; brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common roots; about 10 percent pebbles; strongly acid; clear wavy boundary.
2BC—18 to 23 inches; brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; about 10 percent pebbles; strongly acid; clear wavy boundary.
2C—23 to 60 inches; strong brown (7.5YR 4/6) stratified sand and gravel; single grain; loose; about 25 percent pebbles and 10 percent cobbles; medium acid.

The thickness of the solum and of the loamy mantle ranges from 12 to 24 inches. The content of pebbles ranges from 0 to 10 percent in the loamy mantle and from 10 to 35 percent in the substratum.

The A horizon has hue of 5YR or 7.5YR, or it is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The E horizon has value of 4 to 6. It is sandy loam or fine sandy loam. Some pedons do not have an E horizon. The Bs horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. It is sandy loam, fine sandy loam, or loam. The 2BC horizon has hue of 7.5YR or 5YR and value and chroma of 4 or 5. It is loamy sand, loamy fine sand, or the gravelly analogs of these textures. The 2C horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is gravelly sand or stratified sand and gravel.

Peshekee Series

The Peshekee series consists of shallow, well drained, moderately permeable soils on ground moraines. These soils formed in loamy till underlain by granite. Slope ranges from 4 to 30 percent.

These soils do not have a Bhs horizon, which is definitive for the Peshekee series. This difference, however, does not affect the usefulness or behavior of the soils.

Typical pedon of Peshekee fine sandy loam, in an area of Peshekee-Rock outcrop complex, 4 to 30 percent slopes, 100 feet west and 600 feet north of the southeast corner of sec. 12, T. 31 N., R. 16 E.

A—0 to 3 inches; dark brown (7.5YR 3/2) fine sandy loam, brown (7.5YR 4/2) dry; weak fine granular structure; friable; many roots; about 10 percent pebbles; strongly acid; abrupt smooth boundary.
Bs1—3 to 7 inches; dark brown (7.5YR 3/4) fine sandy loam; weak fine granular structure; friable; many roots; about 10 percent pebbles; very strongly acid; clear wavy boundary.
Bs2—7 to 17 inches; brown (7.5YR 4/4) fine sandy loam; weak medium subangular blocky structure;

friable; common roots; about 10 percent pebbles; very strongly acid; abrupt smooth boundary.
R—17 inches; granite.

The thickness of the solum and the depth to granite range from 10 to 20 inches. The content of pebbles ranges from 5 to 10 percent throughout the profile.

The A horizon has hue of 5YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an E horizon. The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 4 to 6. It is loam, sandy loam, or fine sandy loam.

Rousseau Series

The Rousseau series consists of deep, moderately well drained, rapidly permeable soils on outwash plains and glacial lake plains. These soils formed in sandy deposits. Slope ranges from 1 to 6 percent.

Typical pedon of Rousseau fine sand, 1 to 6 percent slopes, 1,100 feet south and 20 feet west of the northeast corner of sec. 17, T. 26 N., R. 20 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sand, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; very friable; many roots; neutral; abrupt smooth boundary.
Bs1—8 to 15 inches; reddish brown (5YR 4/4) fine sand; weak fine and medium subangular blocky structure; very friable; neutral; abrupt wavy boundary.
Bs2—15 to 30 inches; strong brown (7.5YR 5/6) fine sand; single grain; loose; medium acid; abrupt wavy boundary.
BC—30 to 32 inches; strong brown (7.5YR 4/6) fine sand; common medium distinct brownish yellow (10YR 6/8) mottles; single grain; loose; slightly acid; abrupt wavy boundary.
C1—32 to 48 inches; brown (7.5YR 5/4) fine sand; common fine distinct brownish yellow (10YR 6/6) and few fine distinct yellowish red (5YR 5/6) mottles; single grain; loose; slightly acid; abrupt smooth boundary.
C2—48 to 60 inches; strong brown (7.5YR 5/6) fine sand; common fine faint yellowish red (5YR 4/6), many medium faint yellowish brown (10YR 5/6), and few fine prominent grayish brown (10YR 5/2) mottles; single grain; loose; common medium and coarse dark reddish brown (5YR 3/4) concretions (iron and manganese oxides); slightly acid.

The thickness of the solum ranges from 20 to 32 inches. The Ap horizon has hue of 7.5YR or 10YR and chroma of 2 or 3. Some pedons have an E horizon. The Bs1 horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. The Bs2 horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. The BC horizon has hue of 5YR or 7.5YR and chroma of 4 or 5. The C horizon has value of 5 or 6 and chroma of 4 to 6. It is fine sand or sand.

Seelyeville Series

The Seelyeville series consists of deep, very poorly drained, moderately rapidly permeable soils on ground moraines and outwash plains. These soils formed in organic material derived primarily from herbaceous plants. Slope is 0 to 1 percent.

Typical pedon of Seelyeville muck, in an area of Seelyeville and Markey mucks, 0 to 1 percent slopes, 100 feet north and 1,700 feet east of the southwest corner of sec. 4, T. 28 N., R. 20 E.

Oa1—0 to 8 inches; very dark gray (10YR 3/1), broken face, and black (10YR 2/1), rubbed, sapric material; about 10 percent fiber, 2 percent rubbed; moderate fine subangular blocky structure; many roots; strongly acid (pH 5.5 in water); clear wavy boundary.
Oa2—8 to 17 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 15 percent fiber, 5 percent rubbed; weak coarse and medium subangular blocky structure; friable; common roots; primarily herbaceous fiber and about 2 percent wood fragments; strongly acid (pH 5.5 in water); clear wavy boundary.
Oa3—17 to 26 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 35 percent fiber, 5 percent rubbed; weak coarse and medium subangular blocky structure; friable; few roots; primarily herbaceous fiber; strongly acid (pH 5.5 in water); gradual irregular boundary.
Oa4—26 to 48 inches; very dark brown (10YR 2/2), broken face, and black (10YR 2/1), rubbed, sapric material; about 45 percent fiber, 8 percent rubbed; weak thick platy structure; friable; primarily herbaceous fiber; strongly acid (pH 5.5 in water); abrupt wavy boundary.
Oa5—48 to 60 inches; very dark brown (10YR 2/2), broken face, and black (10YR 2/1), rubbed, sapric material; about 30 percent fiber, 5 percent rubbed; weak thick platy structure; friable; primarily herbaceous fiber; strongly acid (pH 5.5 in water).

The organic material is more than 51 inches thick. It is sapric material or sapric material and as much as 10 inches of hemic material. The content of woody fragments ranges from 0 to 5 percent in the surface tier. The soils have value of 2 or 3 and chroma of 1 or 2 throughout.

Shawano Series

The Shawano series consists of deep, excessively drained, rapidly permeable soils on outwash plains and

glacial lake plains. These soils formed in deposits of fine sand. Slope ranges from 2 to 30 percent.

Typical pedon of Shawano fine sand, 2 to 6 percent slopes, 165 feet east and 330 feet south of the center of sec. 6, T. 27 N., R. 20 E.

A—0 to 4 inches; very dark brown (10YR 2/2) fine sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common roots; very strongly acid; abrupt smooth boundary.
Bw1—4 to 13 inches; brown (7.5YR 4/4) fine sand; weak medium subangular blocky structure; very friable; few roots; strongly acid; gradual wavy boundary.
Bw2—13 to 29 inches; strong brown (7.5YR 4/6) fine sand; weak medium subangular blocky structure; very friable; few roots; medium acid; clear wavy boundary.
C—29 to 60 inches; strong brown (7.5YR 5/6) fine sand; single grain; loose; slightly acid.

The thickness of the solum ranges from 20 to 30 inches. The A horizon has hue of 10YR or 7.5YR and value and chroma of 2 to 4. Some pedons have an AB horizon or an E horizon, or both. The Bw horizon has value of 4 or 5 and chroma of 4 to 6. The C horizon has hue of 10YR or 7.5YR and value and chroma of 5 or 6.

Shiocton Series

The Shiocton series consists of deep, somewhat poorly drained, moderately permeable soils on glacial lake plains. These soils formed in loamy glaciolacustrine deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Shiocton very fine sandy loam, 0 to 3 percent slopes, 1,050 feet north and 50 feet east of the southwest corner of sec. 13, T. 26 N., R. 20 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common roots; neutral; abrupt smooth boundary.
Bw1—9 to 12 inches; yellowish brown (10YR 5/4) very fine sandy loam; moderate medium platy structure; friable; few roots; neutral; abrupt wavy boundary.
Bw2—12 to 16 inches; dark yellowish brown (10YR 4/4) very fine sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; neutral; clear wavy boundary.
Bw3—16 to 22 inches; reddish brown (5YR 4/4) very fine sandy loam; few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; mildly alkaline; abrupt wavy boundary.
C1—22 to 37 inches; brown (7.5YR 5/4) very fine sandy loam; many coarse distinct strong brown (7.5YR 5/6) and few fine prominent pinkish gray (7.5YR 6/2) mottles; massive; very friable; violently effervescent; mildly alkaline; abrupt smooth boundary.
C2—37 to 60 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) stratified silt and very fine sand; common medium prominent brownish yellow (10YR 6/6) mottles; massive; very friable; strongly effervescent; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 20 to 30 inches. The Ap horizon has value of 2 or 3. The Bw horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5, and chroma of 4 to 6. It is very fine sandy loam or silt loam. The C horizon has hue of 7.5YR or 10YR and chroma of 2 to 6. It is very fine sandy loam, silt, silt loam, or very fine sand and is commonly stratified.

Solona Series

The Solona series consists of deep, somewhat poorly drained, moderately permeable soils on ground moraines. These soils formed in calcareous, loamy till. Slope ranges from 0 to 3 percent.

These soils have a thicker and darker Ap horizon than is definitive for the Solona series. This difference, however, does not affect the usefulness or behavior of the soils.

Typical pedon of Solona fine sandy loam, 0 to 3 percent slopes, 1,000 feet east and 200 feet north of the southwest corner of sec. 36, T. 29 N., R. 19 E.

Ap—0 to 9 inches; dark brown (7.5YR 3/2) fine sandy loam, brown (7.5YR 5/2) dry; moderate medium subangular blocky structure; friable; many roots; neutral; abrupt smooth boundary.
Bt1—9 to 14 inches; brown (7.5YR 4/4) sandy loam; common fine prominent yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; friable; few faint clay films on faces of peds; common roots; neutral; clear wavy boundary.
Bt2—14 to 18 inches; reddish brown (5YR 5/4) sandy loam; many coarse prominent yellowish red (5YR 5/8) and few fine distinct reddish gray (5YR 5/2) mottles; weak coarse subangular blocky structure; friable; few faint clay bridges between mineral grains; common roots; about 5 percent pebbles; neutral; gradual wavy boundary.
BC—18 to 22 inches; reddish brown (5YR 5/4) sandy loam; many coarse prominent yellowish red (5YR 5/8) and few fine distinct pinkish gray (5YR 6/2) mottles; weak medium subangular blocky structure; friable; common roots; about 5 percent pebbles; mildly alkaline; gradual wavy boundary.
C1—22 to 26 inches; reddish brown (5YR 5/4) sandy loam; many coarse prominent yellowish red (5YR 5/8) and common medium distinct pinkish gray (5YR 6/2) mottles; massive; friable; few roots; about 10

percent pebbles; slightly effervescent; mildly alkaline; clear wavy boundary.
C2—26 to 60 inches; reddish brown (5YR 5/4) sandy loam; common medium prominent yellowish red (5YR 5/8) mottles; massive; friable; about 10 percent pebbles; slightly effervescent; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 20 to 32 inches. The content of pebbles ranges from 0 to 15 percent in the solum and from 5 to 20 percent in the substratum.

The Ap horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an E horizon. The Bt horizon has hue of 5YR or 7.5YR and value and chroma of 4 or 5. It is sandy loam or loam. Some pedons do not have a BC horizon. The C horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 3 or 4. It is sandy loam, loam, or the gravelly analogs of these textures.

Summerville Series

The Summerville series consists of shallow, well drained, moderately permeable soils on ground moraines and escarpments. These soils formed in loamy till underlain by dolomite. Slope ranges from 2 to 45 percent.

Typical pedon of Summerville fine sandy loam, 2 to 8 percent slopes, 2,300 feet south and 800 feet west of the northeast corner of sec. 6, T. 28 N., R. 21 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak fine and medium granular structure; friable; about 5 percent pebbles; common roots; mildly alkaline; abrupt smooth boundary.
Bs—8 to 12 inches; brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; about 5 percent pebbles; common roots; neutral; abrupt smooth boundary.
BC—12 to 15 inches; dark reddish brown (5YR 3/4) loam; moderate medium subangular blocky structure; friable; about 5 percent pebbles; common roots; mildly alkaline; abrupt smooth boundary.
R—15 inches; dolomite.

The depth to dolomite ranges from 12 to 18 inches. The content of cobbles ranges from 0 to 30 percent throughout the profile.

The Ap or A horizon has hue of 7.5YR or 10YR and value and chroma of 2 or 3. Some pedons have an E horizon. This horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3. The E, Bs, and BC horizons are fine sandy loam, loam, or the cobbly analogs of these textures. The Bs horizon has hue of 5YR or 7.5YR. The BC horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. Some pedons have a C horizon.

Tilleda Series

The Tilleda series consists of deep, well drained, moderately permeable soils on ground moraines and end moraines. These soils formed in loamy till. Slope ranges from 1 to 15 percent.

Typical pedon of Tilleda fine sandy loam, 1 to 6 percent slopes, 360 feet west and 1,650 feet south of the center of sec. 17, T. 29 N., R. 17 E.

Ap—0 to 8 inches; dark brown (7.5YR 3/2) fine sandy loam, brown (7.5YR 5/2) dry; weak fine granular structure; friable; many roots; neutral; abrupt smooth boundary.
E—8 to 12 inches; brown (7.5YR 5/2) fine sandy loam, pinkish gray (7.5YR 6/2) dry; moderate medium platy structure; friable; common roots; neutral; clear wavy boundary.
E/B—12 to 16 inches; about 70 percent tongues of brown (7.5YR 5/2) fine sandy loam (E), pinkish gray (7.5YR 6/2) dry; moderate medium platy structure; friable; reddish brown (5YR 4/4) loam (Bt); moderate medium subangular blocky structure; friable; common roots; slightly acid; clear wavy boundary.
B/E—16 to 22 inches; about 60 percent reddish brown (5YR 4/4) loam (Bt); moderate medium subangular blocky structure; friable; common faint clay films on faces of peds; tongues of brown (7.5YR 5/2) fine sandy loam (E), pinkish gray (7.5YR 6/2) dry; moderate medium platy structure; about 6 percent pebbles; few roots; slightly acid; clear wavy boundary.
Bt1—22 to 34 inches; reddish brown (5YR 4/4) loam; moderate coarse subangular blocky structure; friable; common distinct clay films on faces of peds; about 5 percent pebbles; few roots; slightly acid; gradual wavy boundary.
Bt2—34 to 38 inches; reddish brown (5YR 4/4) loam; moderate medium subangular blocky structure; friable; common faint clay films on faces of peds; about 5 percent pebbles; few roots; medium acid; clear wavy boundary.
C—38 to 60 inches; reddish brown (5YR 4/4) loam; massive; friable; about 3 percent pebbles; neutral.

The thickness of the solum ranges from 30 to 60 inches. The depth to carbonates is 60 inches or more. The content of pebbles ranges from 0 to 10 percent in the solum and from 0 to 25 percent in the substratum.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 1 or 2. Some undisturbed pedons have a Bs horizon. This horizon has hue of 7.5YR and value and chroma of 4. The Bs and E horizons are fine

sandy loam or loam. The E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. The E/B and B/E horizons have colors and textures similar to those of the E and Bt horizons. The Bt horizon has value of 3 or 4 and chroma of 3 to 6. It is loam or clay loam. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is loam, sandy loam, or the gravelly analogs of these textures.

Wainola Series

The Wainola series consists of deep, somewhat poorly drained, rapidly permeable soils on outwash plains and glacial lake plains. These soils formed in sandy deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Wainola loamy fine sand, 0 to 3 percent slopes, 2,145 feet east and 165 feet north of the southwest corner of sec. 25, T. 28 N., R. 21 E.

A—0 to 3 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.

E—3 to 9 inches; brown (10YR 5/3) fine sand, very pale brown (10YR 7/3) dry; very weak fine subangular blocky structure; very friable; common roots; strongly acid; abrupt smooth boundary.

Bs1—9 to 16 inches; dark yellowish brown (10YR 4/4) fine sand; many medium distinct yellowish red (5YR 4/6) mottles; very weak fine subangular blocky structure; very friable; common roots; medium acid; gradual wavy boundary.

Bs2—16 to 30 inches; dark brown (7.5YR 4/4) fine sand; many coarse distinct yellowish red (5YR 4/6) mottles; very weak medium subangular blocky structure; very friable; slightly acid; clear wavy boundary.

C—30 to 60 inches; yellowish brown (10YR 5/4) fine sand; common medium distinct strong brown (7.5YR 4/6) mottles; single grain; loose; slightly acid.

The thickness of the solum ranges from 18 to 30 inches. The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has chroma of 1 to 3. The Bs horizon has hue of 10YR, 7.5YR, or 5YR. It is loamy fine sand or fine sand. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is fine sand or stratified fine sand and loamy fine sand.

Waupaca Series

The Waupaca series consists of deep, poorly drained, moderately slowly permeable soils in glacial lake basins and on flood plains. These soils formed in loamy and silty glaciolacustrine deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Waupaca very fine sandy loam, 0 to 2 percent slopes, 1,200 feet south and 200 feet west of the center of sec. 25, T. 29 N., R. 18 E.

Ap—0 to 9 inches; black (10YR 2/1) very fine sandy loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many roots; mildly alkaline; abrupt smooth boundary.

Cg1—9 to 15 inches; light brownish gray (10YR 6/2) silt loam; many fine prominent yellowish brown (10YR 5/8) mottles; massive; friable; few roots; moderately alkaline; clear wavy boundary.

Cg2—15 to 21 inches; light brownish gray (10YR 6/2) silt loam; many medium prominent brownish yellow (10YR 6/6) mottles; massive; friable; few roots; slightly effervescent; moderately alkaline; gradual wavy boundary.

C—21 to 54 inches; brown (7.5YR 5/4) silt loam; few medium distinct reddish yellow (5YR 6/6) mottles; massive; friable; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cg—54 to 60 inches; grayish brown (10YR 5/2) silt loam; massive; very friable; violently effervescent; moderately alkaline.

The depth to carbonates ranges from 15 to 30 inches. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 4. It is silt loam, silt, or very fine sand and is commonly stratified.

Winterfield Series

The Winterfield series consists of deep, somewhat poorly drained, rapidly permeable soils on flood plains. These soils formed in loamy and sandy alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Winterfield fine sandy loam, 0 to 2 percent slopes, 720 feet east and 165 feet north of the southwest corner of sec. 25, T. 29 N., R. 17 E.

A—0 to 4 inches; dark brown (7.5YR 3/2) fine sandy loam, brown (7.5YR 4/2) dry; moderate fine granular structure; friable; many roots; medium acid; abrupt smooth boundary.

C1—4 to 6 inches; brown (7.5YR 4/4) loamy fine sand; weak medium subangular blocky structure; very friable; few roots; slightly acid; clear wavy boundary.

C2—6 to 18 inches; yellowish brown (10YR 5/4) fine sand; common fine distinct yellowish red (5YR 4/6) mottles; single grain; loose; few roots; slightly acid; clear wavy boundary.

C3—18 to 24 inches; dark brown (7.5YR 4/4) fine sand; common medium faint dark reddish brown (5YR 3/4) and common medium distinct strong brown (7.5YR 5/6) mottles; single grain; loose; slightly acid; clear wavy boundary.

C4—24 to 31 inches; brown (7.5YR 4/4) fine sand; common medium faint reddish brown (5YR 4/4) and common coarse distinct brown (7.5YR 5/2) mottles; single grain; loose; slightly acid; clear wavy boundary.
C5—31 to 41 inches; reddish brown (5YR 4/4) fine sand; common medium distinct reddish gray (5YR 5/2) mottles; weakly cemented sand grains; weak medium subangular blocky structure; very friable; slightly acid; abrupt smooth boundary.
C6—41 to 60 inches; brown (7.5YR 4/2) sand; single grain; loose; about 5 percent woody fragments; mildly alkaline.

The A horizon is 4 to 8 inches thick. It has hue of 7.5YR or 10YR and value and chroma of 2 or 3. The C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 2 to 6. Its textures vary within short horizontal distances. They include sand, fine sand, and loamy fine sand.

Worcester Series

The Worcester series consists of deep, somewhat poorly drained soils on outwash plains. These soils formed in loamy deposits underlain by noncalcareous sand and gravel. They are moderately permeable in the upper part and rapidly permeable or very rapidly permeable in the lower part. Slope ranges from 0 to 3 percent.

Typical pedon of Worcester loam, 0 to 3 percent slopes, 2,600 feet south and 1,120 feet west of the northeast corner of sec. 34, T. 33 N., R. 15 E.

A—0 to 1 inch; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak medium granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.
E—1 to 4 inches; grayish brown (10YR 5/2) loam, light gray (10YR 7/1) dry; weak fine granular structure; friable; common roots; very strongly acid; clear wavy boundary.
Bhs—4 to 7 inches; dark reddish brown (5YR 3/3) sandy loam; weak fine subangular blocky structure; very friable; few roots; very strongly acid; clear wavy boundary.
Bs—7 to 15 inches; brown (7.5YR 4/4) sandy loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few roots; very strongly acid; clear wavy boundary.
E —15 to 20 inches; brown (10YR 5/3) sandy loam, very pale brown (10YR 7/3) dry; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium platy structure; friable; very strongly acid; clear wavy boundary.
Bt—20 to 28 inches; brown (7.5YR 5/4) loam; common medium prominent strong brown (7.5YR 4/6) mottles; moderate medium subangular blocky structure; friable; few faint clay films on faces of peds; very strongly acid; clear wavy boundary.
2C—28 to 60 inches; yellowish brown (10YR 5/4) stratified sand and very gravelly sand; single grain; loose; about 30 percent pebbles; strongly acid.

The thickness of the solum and of the loamy mantle ranges from 26 to 40 inches. The content of pebbles ranges from 0 to 10 percent in the solum and from 10 to 40 percent in the substratum.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The E, Bhs, Bs, E', and Bt horizons are sandy loam or loam. The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. The Bhs and Bs horizons have hue of 7.5YR or 5YR and value and chroma of 3 or 4. These soils have an E' horizon or an E/B horizon, or both. The E' horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. The E/B horizon has colors and textures similar to those of the E' and Bt horizons. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. The 2C horizon has hue of 7.5YR or 10YR and value and chroma of 4 or 5. It is sand or gravelly or very gravelly sand and commonly is stratified.

Formation of the Soils

This section describes the geologic material underlying Oconto County. It also relates the factors of soil formation to the soils in the county and explains the processes of soil formation.

Geology and Underlying Material

Robert N. Cheetham, Jr., geologist, Soil Conservation Service, helped prepare this section.

Oconto County is underlain by igneous, metamorphic, and sedimentary rock. A bedrock geology map shows the rock types and their distribution (*6*). This information is based on previously published and unpublished data and a limited field check of outcrops in the county.

The bedrock is overlain by glacial deposits as much as 300 feet thick. In the northwestern part of the county, these deposits are underlain by a complex of granite and undifferentiated igneous and metamorphic Precambrian rocks that have been folded, faulted, and eroded. Southeast of the Precambrian rocks is Upper Cambrian marine sandstone. Southeast of this sandstone is a series of Ordovician marine sediments, Platteville-Galena dolomite, Saint Peter sandstone, and Prairie du Chien dolomite.

The glacial deposits are till, outwash, and lacustrine material. Minor readvances of a generally receding ice sheet and weathering resulted in glacial tills that differ from one another in color, texture, and depth to free carbonates. In the northwest corner of the county, the till is dominantly brown loamy sand or sandy loam of Middle Woodfordian, Cary age. In some areas of this till, numerous cobbles, stones, and boulders are on the surface. The till in the rest of the county is mostly reddish brown or brown loam or sandy loam. It is Late Woodfordian and Greatlakean in age (*5*).

In the Nicolet National Forest, a broad, pitted outwash plain interfingers with higher lying till deposits. The outwash in the western half of the national forest is mostly stratified sand and gravel. Stones are on the surface in many areas. The outwash in the eastern half of the national forest is mostly sand. The outwash in the west-central part of the county is mostly sand or fine sand deposited along the Oconto River and its tributaries, extending into the Berry Lake area. In the south-central part of the county, from the Oconto River through Little Suamico Township, outwash deposits are extensive and occur as sand, fine sand, or stratified sand and gravel.

Lacustrine material is deposited mainly on a broad plain adjacent to Green Bay, but it also is deposited in scattered areas throughout the county. These deposits range mostly from silt loam to fine sand and have essentially no gravel.

Factors of Soil Formation

The factors that determine the kind of soil that forms at any given point are the composition of the parent material; the climate under which the soil material has accumulated and weathered; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life are the active factors of soil formation. They alter the accumulated material and bring about the development of genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for a soil to form in the parent material. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material is the unweathered material in which the soil forms. It largely determines the chemical and mineralogical composition of the soil. Most of the soils in Oconto County formed in glacial till, glacial outwash, or glaciolacustrine deposits. Some formed in organic deposits.

Glacial till is unstratified, unsorted glacial debris consisting of clay, silt, sand, gravel, stones, and boulders. The different ages of the till are distinguished primarily on the basis of the color, the depth to carbonates, and the texture. Kennan and Keweenaw are examples of soils that formed in the older till, which is dominantly brown sandy loam or loamy sand. Ensley, Nester, Onaway, Solona, and Tilleda are examples of soils that formed in the younger till, which is mostly

brown or reddish brown loam, sandy loam, or silty clay loam. Bonduel, Fairport, and Summerville soils formed in loamy till underlain by dolomite bedrock.

Glacial outwash is material deposited by glacial meltwater. It is generally stratified sand and gravel. In some areas, however, it is almost exclusively sandy. Alpena, Kiva, Minocqua, Oconto, Padus, Pence, and Worcester soils formed mostly in loamy deposits underlain by sand or sand and gravel. Menahga, Rousseau, and Shawano soils formed in sandy deposits.

Lacustrine material is deposited on glacial lake plains. These deposits consist mostly of stratified silt loam, loam, very fine sandy loam, loamy very fine sand, very fine sand, and fine sand. Fence, Shiocton, and Waupaca soils formed in this material.

Organic material consists of sedges, reeds, grasses, and wood fragments in various stages of decomposition. Markey soils formed in organic material 16 to 51 inches deep over sandy deposits. Loxley and Seelyeville soils formed in more than 51 inches of organic material. All of these organic soils are on low lying flats or in depressions and drainageways.

Climate

Climate affects soil formation through its effects on soil moisture and soil temperature. It affects the weathering of rocks and the alteration of parent material through the mechanical action of freezing and thawing and the chemical action generated by the leaching of water. It indirectly affects soil formation through its effects on the plant and animal life on and in the soil.

Variations in climate within the county are too small to cause any great differences among the soils. The county has a humid-temperate continental climate that favors the growth of trees and the formation of soils that have a light colored surface layer and a subsoil in which clay has accumulated.

Plant and Animal Life

Plants and animals significantly affect soil formation. Several biotic processes occur simultaneously in the soil, including the capture of energy through photosynthesis, the decomposition of plant residue, cation exchange, and the formation of organic-mineral complexes.

Most of the soils in the county formed under forest vegetation. As a result, they are light colored and are relatively low in content of organic matter. Also, they are more extensively leached than soils that formed under grasses because tree roots intercept water at greater depths. This leaching removes plant nutrients and allows for clay accumulation at a greater depth. The soils have an abundance of microflora, such as bacteria and fungi, which have significant effects on the decay of organic matter and the recycling of plant nutrients.

Animals in the soil, including earthworms, insects, and rodents, mix the soil and add organic matter, which affects soil structure, porosity, and the content of plant nutrients. Human activities also have important effects on soil formation. They tend to disturb the natural soil-forming processes. The original condition of many soils has been altered by such activities as draining, clearing, burning, and cultivating. Repeated removal of the plant cover has accelerated erosion. Overcultivation has commonly reduced the organic matter content and the rate of water infiltration. Overcultivation and the use of heavy equipment have changed loose, porous surface layers into cloddy layers.

Relief

Relief influences soil formation through its effect on the amount of precipitation absorbed by the soil, the erosion rate, and the movement of material in suspension or solution from one part of the profile to another. Generally, the steeper soils have a thinner solum and are less well developed than the more gently sloping soils. More water percolates through the more gently sloping soils.

Relief directly affects both surface and internal drainage in a soil. The Onaway, Solona, and Ensley soils in Oconto County form a drainage sequence. The slope and landscape position of these soils affect the natural drainage class. The well drained and moderately well drained Onaway soils are on the higher side slopes and are gently sloping to very steep. The somewhat poorly drained Solona soils are in the lower areas and are nearly level and gently sloping. The poorly drained and very poorly drained Ensley soils are on low flats and in drainageways and depressions and are nearly level.

Time

Time has had some effects on differences among the soils in the county. The soils on flood plains, for example, do not have distinct horizons because the soil material has not been in place long enough to be fully affected by the soil-forming processes. On the other hand, well drained soils that formed in glacial till have well defined horizons because the processes have been active for thousands of years.

Processes of Soil Formation

A combination of basic processes is responsible for horizon differentiation in soils. All soils can be affected by these processes. The main processes are gains, losses, transfers, and transformations. They generally do not act alone. Some promote horizon differentiation, and others retard or offset it. The balance among the changes determines the nature of the soil at any given point.

An example of how these soil-forming processes interact is evident in Onaway soils. Because these soils are high on the landscape and are underlain by relatively porous till, they generally are well drained. The parent

material was calcareous loam and sandy loam glacial till in which the content of pebbles, mostly dolomite, was about 5 to 10 percent. The climate favored the growth of plants. Plants and animals contributed to the accumulation of organic matter and organic acids and mixed the soil to some extent. These processes accelerated as more and higher forms of organisms grew in the soil and produced a greater volume of organic residue and acids.

Free lime in the soil material was gradually dissolved and was moved downward into the substratum by percolating water. Suspended particles of clay also were translocated downward by the percolating water. As a result of these transfers, the Onaway soils have no free carbonates in the solum and have more clay in the middle and lower parts of the subsoil than in other parts of the profile.

While free carbonates and clay were moving downward in the profile, organic matter in various stages of decomposition was accumulating on or near the surface. The decomposed organic matter darkened the surface layer.

Chemical weathering of the dolomite and other weatherable minerals and the accumulation of clay gradually changed the middle part of the profile to loam or clay loam in which the content of pebbles is about 5 percent. Because of oxidized iron, which occurs as impurities in the dolomite, this part of the profile is darker than the underlying unweathered till.

The processes that affected the formation of Onaway soils include gains of organic matter in the surface layer, loss of free carbonates from the solum and the subsequent transfer of these carbonates to the substratum, loss of clay from the upper part of the profile and the subsequent transfer of this clay to the middle and lower parts of the subsoil, and the transformation of iron compounds in the subsoil. As a result of these processes, the soils have a surface layer and subsurface layer of fine sandy loam and a subsoil of dominantly loam or clay loam. They are underlain by unweathered, calcareous loam or sandy loam glacial till at a depth of 15 to 30 inches. This till has changed little since it was deposited by the glacier.

All these processes are active in the soils of Oconto County. To a great extent, the kinds of parent material and relief have determined the kinds of processes that are dominant in the formation of all the soils. The kinds of parent material are also largely responsible for differences or similarities among the soils.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Area-selection harvesting. A harvest method in which only trees of a specific size or age are removed.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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.

Clearcutting. Removal of all the timber in a stand when trees are harvested.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

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.

Depth, soil. The thickness of the soil over bedrock. In this survey the depth classes are *deep*, more than 40 inches; *moderately deep*, 20 to 40 inches; and *shallow*, 10 to 20 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper

balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

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.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter is expressed as—

	Percent
Very low	less than 0.5
Low	0.5 to 1.0
Moderately low	1.0 to 2.0
Moderate	2.0 to 4.0
High	4.0 to 8.0
Very high	more than 8.0

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

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.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average

height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes in Oconto County are—

	Percent
Nearly level (simple, complex)	0 to 2
Gently sloping (simple)	2 to 6
Undulating (complex)	2 to 6
Sloping (simple)	6 to 12
Rolling (complex)	6 to 12
Moderately steep (simple)	12 to 20
Hilly (complex)	12 to 20
Steep (simple, complex)	20 to 30
Very steep (simple, complex)	more than 30

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Wind stripcropping. The production of crops in relatively narrow strips that are perpendicular to the direction of prevailing winds.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-80 at Oconto, Wisconsin]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	25.0	5.4	15.2	45	-24	0	1.42	0.60	2.10	4	11.0
February---	29.3	7.7	18.5	48	-18	0	1.16	.38	1.79	4	9.1
March------	38.9	18.5	28.7	62	-10	0	1.91	.73	2.88	5	9.4
April------	54.3	32.0	43.2	83	12	23	2.72	1.43	3.84	6	2.1
May--------	67.4	42.6	55.0	89	24	207	3.37	1.71	4.81	7	.0
June-------	76.9	52.6	64.8	94	35	444	3.51	1.75	5.04	7	.0
July-------	81.6	57.6	69.6	94	42	608	3.44	2.03	4.69	7	.0
August-----	79.5	55.7	67.6	94	40	546	3.34	1.55	4.87	6	.0
September--	70.9	47.3	59.1	90	28	278	3.18	1.38	4.71	7	.0
October----	59.8	37.9	48.9	82	20	112	2.18	.91	3.28	5	.1
November---	43.6	26.2	34.9	67	1	0	1.96	.83	2.91	5	2.5
December---	30.5	13.4	22.0	51	-15	0	1.53	.54	2.34	5	10.7
Yearly:											
Average--	54.8	33.1	44.0	---	---	---	---	---	---	---	---
Extreme--	---	---	---	97	-24	---	---	---	---	---	---
Total----	---	---	---	---	---	2,218	29.72	24.00	34.63	68	44.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-80 at Oconto, Wisconsin]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 2	May 16	May 28
2 years in 10 later than--	Apr. 27	May 11	May 24
5 years in 10 later than--	Apr. 18	May 2	May 16
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 9	Sept. 25	Sept. 16
2 years in 10 earlier than--	Oct. 16	Oct. 1	Sept. 20
5 years in 10 earlier than--	Oct. 27	Oct. 11	Sept. 28

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-80 at Oconto, Wisconsin]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	169	139	117
8 years in 10	177	147	123
5 years in 10	191	161	134
2 years in 10	206	175	146
1 year in 10	213	183	152

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AaE	Alpena gravelly sandy loam, 20 to 35 percent slopes	510	0.1
BnA	Bonduel loam, 0 to 3 percent slopes	1,490	0.2
Bs	Brevort mucky loamy sand, 0 to 2 percent slopes	13,475	2.1
Co	Cormant loamy fine sand, 0 to 1 percent slopes	32,665	5.0
Es	Ensley mucky loam, 0 to 2 percent slopes	13,245	2.0
FpB	Fairport fine sandy loam, 2 to 6 percent slopes	1,560	0.2
FpC	Fairport fine sandy loam, 6 to 12 percent slopes	485	0.1
FsB	Fence very fine sandy loam, 2 to 6 percent slopes	4,165	0.6
FsC	Fence very fine sandy loam, 6 to 12 percent slopes	855	0.1
IsA	Iosco loamy fine sand, 0 to 3 percent slopes	23,400	3.6
KaB	Kennan fine sandy loam, 2 to 6 percent slopes	4,727	0.7
KaC	Kennan fine sandy loam, 6 to 15 percent slopes	12,955	2.0
KaD	Kennan fine sandy loam, 15 to 30 percent slopes	3,425	0.5
KeB	Keweenaw loamy fine sand, 2 to 6 percent slopes	2,610	0.4
KeC	Keweenaw loamy fine sand, 6 to 15 percent slopes	8,910	1.4
KeD	Keweenaw loamy fine sand, 15 to 35 percent slopes	945	0.1
KvB	Kiva sandy loam, 2 to 6 percent slopes	2,095	0.3
KvC	Kiva sandy loam, 6 to 15 percent slopes	1,580	0.2
KvD	Kiva sandy loam, 15 to 35 percent slopes	785	0.1
Lx	Loxley mucky peat, 0 to 1 percent slopes	4,110	0.6
McB	Mancelona loamy sand, 1 to 6 percent slopes	1,715	0.3
McC	Mancelona loamy sand, 6 to 15 percent slopes	795	0.1
MnB	Menahga sand, 0 to 6 percent slopes	22,925	3.5
MnC	Menahga sand, 6 to 15 percent slopes	12,965	2.0
MnD	Menahga sand, 15 to 35 percent slopes	4,530	0.7
MoB	Menominee loamy fine sand, 2 to 6 percent slopes	14,413	2.2
MoC	Menominee loamy fine sand, 6 to 12 percent slopes	4,535	0.7
MoD	Menominee loamy fine sand, 12 to 20 percent slopes	1,425	0.2
Mu	Minocqua mucky fine sandy loam, 0 to 2 percent slopes	2,535	0.4
NeB	Nester silt loam, 1 to 6 percent slopes	1,225	0.2
OcB	Oconto fine sandy loam, 2 to 6 percent slopes	1,755	0.3
OcC	Oconto fine sandy loam, 6 to 12 percent slopes	925	0.1
OcD	Oconto fine sandy loam, 12 to 20 percent slopes	630	0.1
OeB	Onaway fine sandy loam, 1 to 6 percent slopes	44,920	7.0
OeC2	Onaway fine sandy loam, 6 to 12 percent slopes, eroded	15,885	2.4
OeD2	Onaway fine sandy loam, 12 to 20 percent slopes, eroded	5,665	0.9
OeE	Onaway fine sandy loam, 20 to 35 percent slopes	580	0.1
OmB	Onaway fine sandy loam, moderately well drained, 1 to 6 percent slopes	9,570	1.5
OsB	Onaway fine sandy loam, sandy substratum, 2 to 6 percent slopes	1,330	0.2
OvC	Onaway-Kiva-Menahga complex, 4 to 15 percent slopes	3,345	0.5
OvD	Onaway-Kiva-Menahga complex, 15 to 35 percent slopes	4,145	0.6
PaB	Padus fine sandy loam, 1 to 6 percent slopes	23,670	3.6
PaC	Padus fine sandy loam, 6 to 15 percent slopes	17,430	2.7
PaD	Padus fine sandy loam, 15 to 35 percent slopes	6,735	1.0
PeA	Pelkie loamy fine sand, 1 to 3 percent slopes	3,280	0.5
PkB	Pence sandy loam, 1 to 6 percent slopes	12,300	1.9
PkC	Pence sandy loam, 6 to 15 percent slopes	13,650	2.1
PkD	Pence sandy loam, 15 to 35 percent slopes	14,730	2.3
PsD	Peshekee-Rock outcrop complex, 4 to 30 percent slopes	1,980	0.3
Pt	Pits	1,150	0.2
RsB	Rousseau fine sand, 1 to 6 percent slopes	28,875	4.4
Sb	Saprists and Aquents, ponded	4,555	0.7
Sd	Seelyeville and Markey mucks, 0 to 1 percent slopes	71,560	11.1
SfB	Shawano fine sand, 2 to 6 percent slopes	13,320	2.0
SfC	Shawano fine sand, 6 to 12 percent slopes	9,705	1.5
SfD	Shawano fine sand, 12 to 30 percent slopes	3,255	0.5
ShA	Shiocton very fine sandy loam, 0 to 3 percent slopes	9,280	1.4
SoA	Solona fine sandy loam, 0 to 3 percent slopes	46,536	7.2
SpB	Solona-Onaway fine sandy loams, 1 to 6 percent slopes	14,830	2.3
SuB	Summerville fine sandy loam, 2 to 8 percent slopes	520	0.1
SuE	Summerville fine sandy loam, 20 to 45 percent slopes	155	*
TlB	Tilleda fine sandy loam, 1 to 6 percent slopes	5,735	0.9
TlC2	Tilleda fine sandy loam, 6 to 15 percent slopes, eroded	3,145	0.5

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
WaA	Wainola loamy fine sand, 0 to 3 percent slopes	30,045	4.6
Wd	Waupaca very fine sandy loam, 0 to 2 percent slopes	3,080	0.5
Wf	Winterfield fine sandy loam, 0 to 2 percent slopes	8,265	1.3
WrA	Worcester loam, 0 to 3 percent slopes	3,785	0.6
	Water	9,600	1.5
	Total	650,976	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
BnA	Bonduel loam, 0 to 3 percent slopes (where drained)
Es	Ensley mucky loam, 0 to 2 percent slopes (where drained)
FpB	Fairport fine sandy loam, 2 to 6 percent slopes
FsB	Fence very fine sandy loam, 2 to 6 percent slopes
KaB	Kennan fine sandy loam, 2 to 6 percent slopes
NeB	Nester silt loam, 1 to 6 percent slopes
OcB	Oconto fine sandy loam, 2 to 6 percent slopes
OeB	Onaway fine sandy loam, 1 to 6 percent slopes
OmB	Onaway fine sandy loam, moderately well drained, 1 to 6 percent slopes
OsB	Onaway fine sandy loam, sandy substratum, 2 to 6 percent slopes
PaB	Padus fine sandy loam, 1 to 6 percent slopes
ShA	Shiocton very fine sandy loam, 0 to 3 percent slopes (where drained)
SoA	Solona fine sandy loam, 0 to 3 percent slopes (where drained)
SpB	Solona-Onaway fine sandy loams, 1 to 6 percent slopes (where drained)
TlB	Tilleda fine sandy loam, 1 to 6 percent slopes
WrA	Worcester loam, 0 to 3 percent slopes (where drained)

TABLE 6.--LAND CAPABILITY CLASSES AND 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	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
AaE---- Alpena	VIIs	---	---	---	---	---	---
BnA---- Bonduel	IIw	80	12	75	4.0	3.5	3.7
Bs---- Brevort	IIIw	70	10	50	---	2.2	2.5
Co---- Cormant	VIw	---	---	---	---	---	---
Es---- Ensley	IIw	85	15	85	---	3.2	---
FpB---- Fairport	IIe	85	14	60	4.0	---	3.0
FpC---- Fairport	IIIe	80	12	50	4.0	---	2.5
FsB---- Fence	IIe	100	14	75	4.5	3.5	3.3
FsC---- Fence	IIIe	90	12	70	4.0	3.0	2.8
IsA---- Iosco	IIIw	70	11	65	3.5	2.5	4.0
KaB---- Kennan	IIe	85	13	75	4.5	3.5	3.6
KaC---- Kennan	IIIe	75	12	70	4.1	3.1	3.3
KaD---- Kennan	VIe	---	---	---	2.5	---	1.6
KeB---- Keweenaw	IIIe	65	10	60	2.8	2.3	1.5
KeC---- Keweenaw	IIIe	60	8	50	2.3	1.8	1.2
KeD---- Keweenaw	VIIe	---	---	---	1.5	0.7	---
KvB---- Kiva	IIIs	60	12	60	3.2	2.6	1.5
KvC---- Kiva	IVe	55	8	50	1.9	1.5	1.0
KvD---- Kiva	VIIe	---	---	---	---	---	---

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
Lx---------- Loxley	VIw	---	---	---	---	---	---
McB---------- Mancelona	IIIs	70	13	60	3.0	---	2.7
McC---------- Mancelona	IIIe	65	12	55	2.6	---	2.0
MnB, MnC-------- Menahga	IVs	45	8	40	2.5	---	1.2
MnD---------- Menahga	VIIs	---	---	---	---	---	0.7
MoB---------- Menominee	IIIe	70	12	65	4.0	3.0	3.0
MoC---------- Menominee	IVe	60	10	55	3.7	2.7	2.7
MoD---------- Menominee	VIe	---	---	---	3.2	---	2.3
Mu---------- Minocqua	VIw	---	---	---	---	---	2.5
NeB---------- Nester	IIe	100	14	75	4.5	3.5	4.0
OcB---------- Oconto	IIe	70	11	60	3.5	2.5	2.0
OcC---------- Oconto	IIIe	60	9	50	3.0	2.0	1.5
OcD---------- Oconto	IVe	50	8	40	2.5	---	1.0
OeB---------- Onaway	IIe	100	15	75	4.5	3.5	3.5
OeC2---------- Onaway	IIIe	90	12	60	3.8	2.8	3.4
OeD2---------- Onaway	IVe	65	11	50	3.5	---	3.2
OeE---------- Onaway	VIe	---	---	---	3.0	---	3.0
OmB---------- Onaway	IIe	100	15	75	4.5	3.6	3.5
OsB---------- Onaway	IIe	85	13	70	4.0	3.0	3.5
OvC---------- Onaway-Kiva-Menahga	IVe	65	10	53	2.8	2.2	2.5

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
OvD---- Onaway-Kiva-Menahga	VIIe	---	---	---	2.0	---	1.5
PaB---- Padus	IIe	75	12	70	4.0	3.0	2.6
PaC---- Padus	IIIe	65	11	70	3.5	2.5	2.2
PaD---- Padus	VIe	---	---	---	2.5	---	1.2
PeA---- Pelkie	IVs	50	8	50	2.5	2.0	---
PkB---- Pence	IIIe	60	10	60	3.5	2.5	1.8
PkC---- Pence	IVe	50	8	50	3.0	2.0	1.3
PkD---- Pence	VIIe	---	---	---	2.5	---	1.0
PsD**---- Peshekee-Rock outcrop	VIIs	---	---	---	---	---	---
Pt**. Pits							
RsB---- Rousseau	IVs	50	10	40	2.5	2.0	2.1
Sb---- Saprists and Aquents	VIIIw	---	---	---	---	---	---
Sd---- Seelyeville and Markey	VIw	---	---	---	---	---	---
SfB---- Shawano	IVs	55	9	55	3.0	2.0	1.5
SfC---- Shawano	VIs	45	7	30	2.5	1.5	1.0
SfD---- Shawano	VIIs	---	---	---	2.0	---	0.3
ShA---- Shiocton	IIw	95	13	75	4.5	3.5	4.0
SoA---- Solona	IIw	100	14	75	4.5	3.5	4.0
SpB---- Solona-Onaway	IIw	87	14	75	4.5	3.5	---
SuB---- Summerville	IIIe	60	10	60	3.5	2.0	2.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Bromegrass-alfalfa hay	Timothy-red clover hay	Kentucky bluegrass
		Bu	Tons	Bu	Tons	Tons	AUM*
SuE---------- Summerville	VIIe	---	---	---	---	---	---
TlB---------- Tilleda	IIe	100	15	75	5.0	4.0	4.0
TlC2---------- Tilleda	IIIe	90	14	70	5.0	3.5	3.5
WaA---------- Wainola	IVw	65	11	60	3.0	2.5	---
Wd---------- Waupaca	VIw	---	---	---	---	---	---
Wf---------- Winterfield	VIIw	---	---	---	---	---	---
WrA---------- Worcester	IIw	75	10	70	4.0	3.0	2.6

* 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.--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				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
AaE---------- Alpena	3R	Moderate	Moderate	Severe	Slight	Northern white-cedar	33	48	Red pine, jack pine.
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						Paper birch---------	48	47	
BnA---------- Bonduel	4W	Slight	Moderate	Slight	Moderate	Northern white-cedar	35	51	Red maple, white spruce, white ash.
						Quaking aspen-------	---	---	
						Paper birch---------	---	---	
						Red maple-----------	---	---	
Bs---------- Brevort	8W	Slight	Severe	Severe	Severe	Balsam fir----------	55	107	
						Quaking aspen-------	40	22	
						Northern white-cedar	39	58	
						American basswood---	---	---	
						Red maple-----------	---	---	
						Black spruce--------	15	23	
Co---------- Cormant	4W	Slight	Severe	Severe	Severe	Quaking aspen-------	60	64	Eastern white pine, white spruce.
						Black ash-----------	---	---	
						Balsam fir----------	---	---	
Es---------- Ensley	3W	Slight	Severe	Severe	Severe	Red maple-----------	62	39	
						Balsam fir----------	60	118	
						White spruce--------	---	---	
						White ash-----------	---	---	
						Yellow birch--------	---	---	
FpB, FpC-------- Fairport	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	White spruce, eastern white pine, Norway spruce.
						American basswood---	---	---	
						Northern red oak----	66	48	
						White ash-----------	---	---	
FsB, FsC-------- Fence	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	Red pine, eastern white pine, white spruce.
						Yellow birch--------	---	---	
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
IsA---------- Iosco	3S	Slight	Slight	Slight	Slight	Northern red oak----	65	48	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	---	
						Red pine------------	---	---	
						Yellow birch--------	---	---	
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
KaB, KaC-------- Kennan	3A	Slight	Slight	Slight	Slight	Sugar maple---------	68	42	Red pine, white spruce, eastern white pine.
						Northern red oak----	76	58	
						American basswood---	72	44	
						White ash-----------	77	91	
						Bigtooth aspen------	---	---	
						Quaking aspen-------	---	---	
						Yellow birch--------	---	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
KaD---------- Kennan	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	68	42	Red pine, white spruce, eastern white pine.
						Northern red oak----	76	58	
						American basswood---	72	44	
						White ash----------	77	91	
						Bigtooth aspen------	---	---	
						Quaking aspen-------	---	---	
						Yellow birch--------	---	---	
KeB, KeC-------- Keweenaw	3S	Slight	Slight	Moderate	Slight	Sugar maple---------	61	38	Red pine, eastern white pine.
						Eastern hemlock-----	---	---	
						Yellow birch--------	---	---	
						Northern red oak----	67	49	
						Paper birch---------	---	---	
						Bigtooth aspen------	---	---	
						Black cherry--------	---	---	
						Eastern white pine--	---	---	
						Red pine-----------	56	90	
KeD---------- Keweenaw	3R	Moderate	Moderate	Moderate	Slight	Sugar maple---------	61	38	Red pine, eastern white pine.
						Eastern hemlock-----	---	---	
						Yellow birch--------	---	---	
						Northern red oak----	67	49	
						Paper birch---------	---	---	
						Bigtooth aspen------	---	---	
						Black cherry--------	---	---	
						Eastern white pine--	---	---	
						Red pine-----------	56	90	
KvB, KvC-------- Kiva	3A	Slight	Slight	Slight	Slight	Sugar maple---------	61	38	Red pine, imperial Carolina poplar, eastern white pine.
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
						White spruce--------	---	---	
						Balsam fir----------	---	---	
KvD---------- Kiva	3R	Moderate	Severe	Slight	Slight	Sugar maple---------	61	38	Red pine, imperial Carolina poplar, eastern white pine.
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
						White spruce--------	---	---	
						Balsam fir----------	---	---	
Lx---------- Loxley	2W	Slight	Severe	Severe	Severe	Black spruce--------	15	23	
						Tamarack-----------	---	---	
						Balsam fir----------	---	---	
McB, McC-------- Mancelona	3S	Slight	Slight	Moderate	Slight	Sugar maple---------	58	37	Red pine, eastern white pine.
						Northern red oak----	---	---	
						Red pine-----------	---	---	
						Jack pine----------	---	---	
						Eastern white pine--	---	---	
						Yellow birch--------	---	---	
MnB, MnC-------- Menahga	6S	Slight	Moderate	Moderate	Slight	Jack pine----------	59	88	Red pine, white spruce, eastern white pine, jack pine.
						Red pine-----------	58	96	
						Eastern white pine--	58	115	
						Quaking aspen-------	63	70	
						Northern pin oak----	55	38	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
MnD---------- Menahga	6R	Moderate	Moderate	Moderate	Slight	Jack pine----------	59	88	Red pine, white spruce, eastern white pine, jack pine.
						Red pine----------	58	96	
						Eastern white pine--	58	115	
						Quaking aspen-------	63	70	
						Northern pin oak----	55	38	
MoB, MoC, MoD--- Menominee	4S	Slight	Slight	Moderate	Slight	Northern red oak----	73	55	Red pine, eastern white pine, white spruce.
						Sugar maple---------	66	41	
						American basswood---	---	---	
						Red maple----------	---	---	
Mu---------- Minocqua	7W	Slight	Severe	Severe	Severe	Balsam fir----------	54	105	Red maple, white ash, white spruce, black spruce.
						Red maple----------	55	35	
						White ash----------	---	---	
						Black ash----------	---	---	
						Tamarack----------	55	50	
						Northern white-cedar	---	---	
						Quaking aspen-------	---	---	
NeB---------- Nester	3A	Slight	Slight	Slight	Slight	Sugar maple---------	61	38	White spruce, red pine, Norway spruce, eastern white pine, imperial Carolina poplar.
						Quaking aspen-------	---	---	
						White ash----------	---	---	
						American basswood---	---	---	
						Northern red oak----	---	---	
						White oak----------	---	---	
						Black cherry--------	---	---	
OcB, OcC, OcD--- Oconto	3A	Slight	Slight	Slight	Slight	Sugar maple---------	70	43	Eastern white pine, red pine, white spruce.
						American basswood---	---	---	
						White ash----------	---	---	
						Northern red oak----	---	---	
OeB, OeC2------- Onaway	3A	Slight	Slight	Slight	Slight	Sugar maple---------	63	39	White spruce, Norway spruce, red pine.
						Quaking aspen-------	---	---	
						Balsam fir----------	---	---	
						Yellow birch--------	---	---	
						Northern red oak----	68	50	
						Red pine----------	---	---	
						American basswood---	---	---	
						White ash----------	---	---	
OeD2, OeE------- Onaway	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	63	39	White spruce, Norway spruce, red pine.
						Quaking aspen-------	---	---	
						Balsam fir----------	---	---	
						Yellow birch--------	---	---	
						Northern red oak----	68	50	
						Red pine----------	---	---	
						American basswood---	---	---	
						White ash----------	---	---	
OmB---------- Onaway	3A	Slight	Slight	Slight	Slight	Sugar maple---------	63	39	White spruce, Norway spruce, red pine.
						Quaking aspen-------	---	---	
						Balsam fir----------	---	---	
						Yellow birch--------	---	---	
						Northern red oak----	68	50	
						Red pine----------	---	---	
						American basswood---	---	---	
						White ash----------	---	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
OsB---------- Onaway	3A	Slight	Slight	Slight	Slight	Sugar maple---------	63	39	Eastern white pine, red pine, white spruce.
						American basswood---	---	---	
						White ash----------	---	---	
						Quaking aspen-------	---	---	
						Eastern white pine--	---	---	
						Northern red oak----	68	50	
OvC**:									
Onaway---------	3A	Slight	Slight	Slight	Slight	Sugar maple---------	63	39	White spruce, red pine, Norway spruce.
						Quaking aspen-------	---	---	
						Balsam fir----------	---	---	
						Yellow birch--------	---	---	
						Northern red oak----	68	50	
						Red pine------------	---	---	
						American basswood---	---	---	
						White ash----------	---	---	
Kiva----------	3A	Slight	Slight	Slight	Slight	Sugar maple---------	61	38	Red pine, imperial Carolina poplar, eastern white pine.
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
						White spruce--------	---	---	
						Balsam fir----------	---	---	
Menahga--------	6S	Slight	Moderate	Moderate	Slight	Jack pine----------	59	88	Red pine, white spruce, eastern white pine, jack pine.
						Red pine------------	58	96	
						Eastern white pine--	58	115	
						Quaking aspen-------	63	70	
						Northern pin oak----	55	38	
OvD**:									
Onaway---------	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	63	39	White spruce, red pine, Norway spruce.
						Quaking aspen-------	---	---	
						Balsam fir----------	---	---	
						Yellow birch--------	---	---	
						Northern red oak----	68	50	
						Red pine------------	---	---	
						American basswood---	---	---	
						White ash----------	---	---	
Kiva----------	3R	Moderate	Severe	Slight	Slight	Sugar maple---------	61	38	Red pine, imperial Carolina poplar, eastern white pine.
						American basswood---	---	---	
						Quaking aspen-------	---	---	
						Bigtooth aspen------	---	---	
						White spruce--------	---	---	
						Balsam fir----------	---	---	
Menahga--------	6R	Moderate	Moderate	Moderate	Slight	Jack pine----------	59	88	Red pine, white spruce, eastern white pine, jack pine.
						Red pine------------	58	96	
						Eastern white pine--	58	115	
						Quaking aspen-------	63	70	
						Northern pin oak----	55	38	
PaB, PaC-------- Padus	3A	Slight	Slight	Slight	Slight	Sugar maple---------	67	41	Red pine, eastern white pine, white spruce.
						Northern red oak----	70	52	
						Bigtooth aspen------	78	91	
						White ash----------	---	---	
						American basswood---	---	---	
						Red pine------------	---	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
PaD---------- Padus	3R	Moderate	Moderate	Slight	Slight	Sugar maple---------	67	41	Red pine, eastern white pine, white spruce.
						Northern red oak----	70	52	
						Bigtooth aspen------	78	91	
						White ash-----------	---	---	
						American basswood---	---	---	
						Red pine------------	---	---	
PeA---------- Pelkie	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	Red pine, white spruce, Norway spruce.
						American elm--------	---	---	
						Red maple-----------	---	---	
						American basswood---	---	---	
						Yellow birch--------	---	---	
						White spruce--------	---	---	
						American basswood---	---	---	
PkB, PkC-------- Pence	7S	Slight	Slight	Moderate	Slight	Red pine------------	59	99	Red pine, eastern white pine, jack pine.
						Sugar maple---------	59	37	
						Eastern white pine--	57	112	
						American basswood---	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						Paper birch---------	---	---	
						Yellow birch--------	---	---	
PkD---------- Pence	7R	Moderate	Moderate	Moderate	Slight	Red pine------------	59	99	Red pine, eastern white pine, jack pine.
						Sugar maple---------	59	37	
						Eastern white pine--	57	112	
						American basswood---	---	---	
						Balsam fir----------	---	---	
						Quaking aspen-------	---	---	
						Paper birch---------	---	---	
						Yellow birch--------	---	---	
PsD**: Peshekee-------	2D	Slight	Slight	Moderate	Severe	Sugar maple---------	53	34	Eastern white pine, white spruce.
						Eastern white pine--	53	99	
						Red pine------------	---	---	
						Yellow birch--------	---	---	
						Balsam fir----------	---	---	
						Paper birch---------	56	59	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern hemlock-----	---	---	
						White spruce--------	---	---	
Rock outcrop.									
RsB---------- Rousseau	3S	Slight	Moderate	Severe	Slight	Sugar maple---------	65	73	Red pine, jack pine.
						Quaking aspen-------	60	38	
						Red maple-----------	---	---	
						Balsam fir----------	---	---	
						Northern red oak----	70	52	
						Eastern hemlock-----	---	---	
						Red pine------------	56	90	
						Jack pine-----------	62	92	
						Paper birch---------	65	73	
						Yellow birch--------	---	---	
						Bigtooth aspen------	---	---	
Sd**: Seelyeville----	8W	Slight	Severe	Severe	Severe	Balsam fir----------	59	116	
						Tamarack------------	---	---	
						Northern white-cedar	33	48	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
Sd**:									
Markey	7W	Slight	Severe	Severe	Severe	Balsam fir	52	100	
						Quaking aspen	45	32	
						Black spruce	---	---	
						Tamarack	47	38	
						Black ash	---	---	
						Northern white-cedar	41	61	
						Red maple	---	---	
						White spruce	46	87	
SfB, SfC	3S	Slight	Slight	Moderate	Slight	Northern red oak	62	45	Red pine, eastern white pine, jack pine.
Shawano						Red pine	---	---	
						Eastern white pine	---	---	
						Jack pine	---	---	
						Paper birch	---	---	
SfD	3R	Moderate	Moderate	Moderate	Slight	Northern red oak	62	45	Red pine, eastern white pine, jack pine.
Shawano						Red pine	---	---	
						Eastern white pine	---	---	
						Jack pine	---	---	
						Paper birch	---	---	
ShA	3W	Slight	Moderate	Slight	Moderate	Red maple	65	40	Eastern white pine, white spruce, silver maple, white ash.
Shiocton						Sugar maple	---	---	
						Northern red oak	---	---	
						American basswood	---	---	
						Bigtooth aspen	---	---	
SoA	3W	Slight	Moderate	Slight	Moderate	Sugar maple	64	40	Eastern white pine, white ash, white spruce.
Solona						Northern red oak	---	---	
						White ash	---	---	
						American basswood	---	---	
SpB**:									
Solona	3W	Slight	Moderate	Slight	Moderate	Sugar maple	64	40	Eastern white pine, white ash, white spruce.
						Northern red oak	---	---	
						White ash	---	---	
						American basswood	---	---	
Onaway	3A	Slight	Slight	Slight	Slight	Sugar maple	63	39	White spruce, Norway spruce, red pine.
						Quaking aspen	---	---	
						Balsam fir	---	---	
						Yellow birch	---	---	
						Northern red oak	68	50	
						Red pine	---	---	
						American basswood	---	---	
						White ash	---	---	
SuB	2D	Slight	Slight	Moderate	Severe	Sugar maple	50	32	Northern white-cedar, eastern white pine, Norway spruce.
Summerville						Paper birch	53	53	
						Northern white-cedar	---	---	
						Red pine	43	60	
						Eastern white pine	---	---	
						Northern red oak	50	27	
SuE	2R	Severe	Severe	Severe	Severe	Sugar maple	50	32	
Summerville						Paper birch	53	53	
						Northern white-cedar	---	---	
						Red pine	43	60	
						Eastern white pine	---	---	
						Northern red oak	50	27	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
T1B, T1C2---- Tilleda	4A	Slight	Slight	Slight	Slight	Northern red oak----	73	55	Red pine, eastern white pine, white spruce.
						Sugar maple----------	71	44	
						Red maple----------	---	---	
						Eastern white pine--	---	---	
WaA---------- Wainola	8W	Slight	Moderate	Slight	Moderate	Red pine----------	62	107	White spruce, Norway spruce, eastern white pine.
						White ash----------	75	78	
						Red maple----------	77	48	
						Northern red oak----	74	56	
Wd---------- Waupaca	3W	Slight	Severe	Moderate	Moderate	Silver maple--------	93	45	Silver maple, red maple, white ash.
						Red maple----------	---	---	
						White ash----------	80	98	
Wf---------- Winterfield	3W	Slight	Severe	Moderate	Severe	Northern red oak----	55	38	White spruce, eastern white pine, black spruce, northern white-cedar.
						Red maple----------	65	40	
						Yellow birch--------	---	---	
						White spruce--------	---	---	
						White ash----------	---	---	
						Balsam fir----------	---	---	
						Red pine----------	---	---	
						Eastern white pine--	---	---	
WrA---------- Worcester	2W	Slight	Moderate	Slight	Moderate	Red maple----------	55	35	Eastern white pine, red maple, white spruce.
						Sugar maple---------	---	---	
						Yellow birch--------	---	---	
						Balsam fir----------	---	---	
						White spruce--------	---	---	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AaE. Alpena					
BnA---------- Bonduel	---	Common ninebark, northern white-cedar, redosier dogwood, nannyberry viburnum, lilac, American cranberrybush, silky dogwood.	White spruce------	Eastern white pine, white ash, silver maple, red maple.	---
Bs---------- Brevort	American cranberrybush, silky dogwood.	Northern white-cedar, Amur privet, lilac, common ninebark.	Manchurian crabapple, green ash, white spruce.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
Co. Cormant					
Es---------- Ensley	---	American cranberrybush, Roselow sargent crabapple, silky dogwood, Amur privet, nannyberry viburnum, common ninebark.	White spruce, northern white-cedar.	Eastern white pine, green ash, red maple.	---
FpB, FpC---------- Fairport	Siberian peashrub	Arrowwood, silky dogwood, Manchurian crabapple, gray dogwood.	White spruce, northern white-cedar, eastern white pine, jack pine, Norway spruce.	Red maple, white ash.	Imperial Carolina poplar.
FsB, FsC---------- Fence	---	Northern white-cedar, lilac, silky dogwood, American cranberrybush, Amur maple, gray dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine, red maple, white ash.	---
IsA---------- Iosco	---	Northern white-cedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood.	White spruce------	Eastern white pine, red pine, white ash, red maple, silver maple.	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
KaB, KaC, KaD----- Kennan	Manyflower cotoneaster.	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
KeB, KeC, KeD----- Keweenaw	---	Siberian crabapple, lilac, American cranberrybush, Amur maple, redosier dogwood, nannyberry viburnum, Siberian peashrub.	White spruce, northern white-cedar.	Red pine, Norway spruce, eastern white pine.	---
KvB, KvC, KvD----- Kiva	Manyflower cotoneaster.	Amur privet, Siberian crabapple, arrowwood, American cranberrybush.	White spruce, eastern redcedar.	Red pine, eastern white pine, jack pine, Norway spruce.	Imperial Carolina poplar.
Lx---------- Loxley	---	Common ninebark, nannyberry viburnum, silky dogwood.	Northern white-cedar.	Siberian crabapple, eastern white pine, green ash.	---
McB, McC---------- Mancelona	---	Amur maple, lilac, eastern redcedar, Siberian peashrub, nannyberry viburnum.	White spruce, Siberian crabapple, northern white-cedar.	Red pine, jack pine, eastern white pine, Norway spruce.	---
MnB, MnC, MnD----- Menahga	Manyflower cotoneaster.	Gray dogwood, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, lilac, eastern redcedar.	Norway spruce-----	Jack pine, red pine, eastern white pine.	---
MoB, MoC, MoD----- Menominee	Manyflower cotoneaster.	Eastern redcedar, lilac, Siberian peashrub, silky dogwood, Amur maple, gray dogwood, American cranberrybush.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
Mu. Minocqua					

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
NeB---------- Nester	---	Arrowwood, lilac, common ninebark, Amur privet, silky dogwood, nannyberry viburnum.	White spruce, Siberian crabapple.	Red pine, green ash, eastern white pine.	Imperial Carolina poplar.
OcB, OcC, OcD----- Oconto	Manyflower cotoneaster.	Lilac, Siberian peashrub, eastern redcedar, American cranberrybush, Amur maple, gray dogwood, silky dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
OeB, OeC2, OeD2, OeE---------- Onaway	---	Nannyberry viburnum, silky dogwood, lilac, American cranberrybush.	White spruce, Amur maple, northern white-cedar.	Red pine, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
OmB---------- Onaway	---	Lilac, silky dogwood, nannyberry viburnum, Amur privet, arrowwood, Siberian crabapple, American cranberrybush.	White spruce------	Red pine, Norway spruce, eastern white pine.	Imperial Carolina poplar.
OsB---------- Onaway	---	Northern white-cedar, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine, white ash, red maple.	---
OvC*, OvD*: Onaway----------	---	Nannyberry viburnum, silky dogwood, lilac, American cranberrybush.	White spruce, Amur maple, northern white-cedar.	Red pine, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
Kiva----------	Manyflower cotoneaster.	Amur privet, Siberian crabapple, arrowwood, American cranberrybush.	White spruce, eastern redcedar.	Red pine, eastern white pine, jack pine, Norway spruce.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
OvC*, OvD*: Menahga	Manyflower cotoneaster.	Gray dogwood, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, lilac, eastern redcedar.	Norway spruce	Jack pine, red pine, eastern white pine.	---
PaB, PaC, PaD Padus	Manyflower cotoneaster.	Gray dogwood, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, lilac, eastern redcedar.	Norway spruce	Jack pine, red pine, eastern white pine.	---
PeA Pelkie	---	American cranberrybush, silky dogwood, Amur privet, lilac.	White spruce, Siberian crabapple, northern white-cedar, Norway spruce.	Red pine, eastern white pine, green ash, jack pine.	Imperial Carolina poplar.
PkB, PkC, PkD Pence	Manyflower cotoneaster.	Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
PsD*: Peshekee.					
Rock outcrop.					
Pt*. Pits					
RsB Rousseau	Vanhoutte spirea, manyflower cotoneaster.	Siberian crabapple, silky dogwood, Amur privet.	White spruce, eastern redcedar.	Red pine, eastern white pine, jack pine, Norway spruce.	Imperial Carolina poplar.
Sb*: Saprists.					
Aquents.					
Sd*: Seelyeville	---	Northern white-cedar, late lilac, American cranberrybush, common ninebark, silky dogwood, nannyberry viburnum, redosier dogwood.	White spruce, Japanese tree lilac, Manchurian crabapple.	Siberian crabapple.	Imperial Carolina poplar.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Sd*: Markey	---	Northern white-cedar, late lilac, American cranberrybush, common ninebark, silky dogwood, nannyberry viburnum, redosier dogwood.	White spruce, Japanese tree lilac, Manchurian crabapple.	Siberian crabapple.	Imperial Carolina poplar.
SfB, SfC, SfD----- Shawano	Manyflower cotoneaster.	Siberian peashrub, lilac, eastern redcedar, silky dogwood, Amur maple, gray dogwood, American cranberrybush.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
ShA---------- Shiocton	---	Common ninebark, lilac, silky dogwood, northern white-cedar, redosier dogwood, American cranberrybush, nannyberry viburnum.	White spruce------	Eastern white pine, silver maple, white ash, red maple.	---
SoA---------- Solona	---	Common ninebark, lilac, silky dogwood, northern white-cedar, American cranberrybush, redosier dogwood, nannyberry viburnum.	White spruce------	Eastern white pine, white ash, silver maple, red maple.	---
SpB*: Solona----------	---	Common ninebark, lilac, silky dogwood, northern white-cedar, American cranberrybush, redosier dogwood, nannyberry viburnum.	White spruce------	Eastern white pine, white ash, silver maple, red maple.	---
Onaway----------	---	Lilac, silky dogwood, nannyberry viburnum, Amur privet, arrowwood, Siberian crabapple, American cranberrybush.	White spruce------	Red pine, Norway spruce, eastern white pine.	Imperial Carolina poplar.
SuB, SuE. Summerville					

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
T1B, T1C2--------- Tilleda	---	Northern white-cedar, lilac, American cranberrybush, gray dogwood, Amur maple.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, red maple, white ash.	---
WaA---------- Wainola	---	White spruce, silky dogwood, American cranberrybush, Amur privet, nannyberry viburnum.	Northern white-cedar, Manchurian crabapple.	Norway spruce, eastern white pine, golden willow, red pine.	Imperial Carolina poplar.
Wd. Waupaca					
Wf. Winterfield					
WrA---------- Worcester	---	Common ninebark, northern white-cedar, nannyberry viburnum, American cranberrybush, redosier dogwood, silky dogwood, lilac.	White spruce------	Eastern white pine, silver maple, red maple, white ash.	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--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
AaE Alpena	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, droughty, slope.
BnA Bonduel	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, depth to rock.
Bs Brevort	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Co Cormant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Es Ensley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
FpB Fairport	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight	Moderate: depth to rock.
FpC Fairport	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.
FsB Fence	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
FsC Fence	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
IsA Iosco	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
KaB Kennan	Slight	Slight	Moderate: small stones, slope.	Slight	Moderate: large stones.
KaC Kennan	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
KaD Kennan	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
KeB Keweenaw	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
KeC Keweenaw	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
KeD--- Keweenaw	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KvB--- Kiva	Slight---	Slight---	Moderate: slope, small stones.	Slight---	Moderate: large stones, droughty.
KvC--- Kiva	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---	Moderate: large stones, droughty.
KvD--- Kiva	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lx--- Loxley	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.	Severe: too acid, ponding, excess humus.
McB--- Mancelona	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight---	Moderate: small stones, droughty.
McC--- Mancelona	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight---	Moderate: small stones, droughty, slope.
MnB--- Menahga	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
MnC--- Menahga	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: too sandy.
MnD--- Menahga	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.
MoB--- Menominee	Slight---	Slight---	Moderate: slope.	Slight---	Moderate: droughty.
MoC--- Menominee	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---	Moderate: droughty, slope.
MoD--- Menominee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Mu--- Minocqua	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
NeB--- Nester	Slight---	Slight---	Moderate: slope.	Slight---	Slight.
OcB--- Oconto	Slight---	Slight---	Moderate: slope, small stones.	Slight---	Moderate: droughty.
OcC--- Oconto	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---	Moderate: droughty, slope.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
OcD---------- Oconto	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
OeB---------- Onaway	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: large stones.
OeC2---------- Onaway	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, slope.
OeD2---------- Onaway	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
OeE---------- Onaway	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
OmB---------- Onaway	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: large stones.
OsB---------- Onaway	Slight----------	Slight----------	Moderate: slope, small stones.	Moderate: large stones.	Moderate: large stones.
OvC*: Onaway----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, slope.
Kiva----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, droughty.
Menahga----------	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: too sandy.
OvD*: Onaway----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kiva----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Menahga----------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.
PaB---------- Padus	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: large stones, droughty.
PaC---------- Padus	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, droughty, slope.
PaD---------- Padus	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
PeA---------- Pelkie	Severe: flooding.	Slight----------	Moderate: slope, flooding.	Slight----------	Moderate: droughty, flooding.
PkB---------- Pence	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: large stones, droughty.
PkC---------- Pence	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: large stones, droughty, slope.
PkD---------- Pence	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
PsD*: Peshekee----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.	Severe: slope, depth to rock.
Rock outcrop.					
Pt*. Pits					
RsB---------- Rousseau	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
Sb*: Saprists.					
Aquents.					
Sd*: Seelyeville----------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Markey----------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
SfB---------- Shawano	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
SfC---------- Shawano	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope.
SfD---------- Shawano	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
ShA---------- Shiocton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
SoA---------- Solona	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SpB*:					
Solona	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Onaway	Slight	Slight	Moderate: slope.	Slight	Moderate: large stones.
SuB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: depth to rock.
Summerville					
SuE	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.
Summerville					
TlB	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
Tilleda					
TlC2	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
Tilleda					
WaA	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Wainola					
Wd	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
Waupaca					
Wf	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Winterfield					
WrA	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness, droughty.
Worcester					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AaE---- Alpena	Very poor.	Very poor.	Poor	Fair	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.
BnA---- Bonduel	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Bs---- Brevort	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Poor.
Co---- Cormant	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Es---- Ensley	Good	Good	Poor	Poor	Poor	Good	Good	Good	Poor	Good.
FpB, FpC---- Fairport	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
FsB---- Fence	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
FsC---- Fence	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
IsA---- Iosco	Fair	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
KaB, KaC---- Kennan	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
KaD---- Kennan	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
KeB---- Keweenaw	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
KeC---- Keweenaw	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
KeD---- Keweenaw	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
KvB---- Kiva	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
KvC---- Kiva	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
KvD---- Kiva	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Lx---- Loxley	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
McB, McC---- Mancelona	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
MnB, MnC---------- Menahga	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
MnD---------- Menahga	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
MoB, MoC, MoD------ Menominee	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Mu---------- Minocqua	Fair	Good	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
NeB---------- Nester	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OcB, OcC---------- Oconto	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OcD---------- Oconto	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
OeB---------- Onaway	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OeC2---------- Onaway	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
OeD2---------- Onaway	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
OeE---------- Onaway	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
OmB, OsB---------- Onaway	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OvC*:										
Onaway----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Kiva----------	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Menahga----------	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
OvD*:										
Onaway----------	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kiva----------	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Menahga----------	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
PaB, PaC---------- Padus	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
PaD---------- Padus	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
PeA---------- Pelkie	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
PkB, PkC---------- Pence	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
PkD---------- Pence	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
PsD*: Peshekee----------	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
Pt*. Pits										
RsB---------- Rousseau	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Poor.
Sb*: Saprists.										
Aquents.										
Sd*: Seelyeville-------	Poor	Poor	Poor	Poor	Good	Good	Good	Poor	Fair	Good.
Markey----------	Poor	Poor	Poor	Poor	Good	Good	Good	Poor	Fair	Good.
SfB, SfC---------- Shawano	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
SfD---------- Shawano	Very poor.	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
ShA---------- Shiocton	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
SoA---------- Solona	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
SpB*: Solona----------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Onaway----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SuB, SuE---------- Summerville	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.
T1B---------- Tilleda	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Very poor.
T1C2---------- Tilleda	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
WaA---------- Wainola	Fair	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
Wd---------- Waupaca	Good	Fair	Fair	Fair	Fair	Good	Good	Good	Good	Good.
Wf---------- Winterfield	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
WrA---------- Worcester	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AaE---------- Alpena	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.
BnA---------- Bonduel	Severe: depth to rock, wetness.	Severe: wetness.	Severe: wetness, depth to rock.	Severe: wetness.	Severe: frost action.	Moderate: wetness, depth to rock.
Bs---------- Brevort	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Co---------- Cormant	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Es---------- Ensley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
FpB---------- Fairport	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength.	Moderate: depth to rock.
FpC---------- Fairport	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, depth to rock.
FsB---------- Fence	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Severe: frost action.	Slight.
FsC---------- Fence	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
IsA---------- Iosco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
KaB---------- Kennan	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
KaC---------- Kennan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
KaD---------- Kennan	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KeB---------- Keweenaw	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: large stones.

TABLE 11.--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
KeC---------- Keweenaw	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, slope.
KeD---------- Keweenaw	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KvB---------- Kiva	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: large stones, droughty.
KvC---------- Kiva	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty.
KvD---------- Kiva	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lx---------- Loxley	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: too acid, ponding, excess humus.
McB---------- Mancelona	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: small stones, droughty.
McC---------- Mancelona	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, droughty, slope.
MnB---------- Menahga	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: too sandy.
MnC---------- Menahga	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: too sandy.
MnD---------- Menahga	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, too sandy.
MoB---------- Menominee	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
MoC---------- Menominee	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
MoD---------- Menominee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mu---------- Minocqua	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
NeB---------- Nester	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
OcB---------- Oconto	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.

TABLE 11.--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
OcC---------- Oconto	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
OcD---------- Oconto	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
OeB---------- Onaway	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: large stones.
OeC2---------- Onaway	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
OeD2, OeE--------- Onaway	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
OmB---------- Onaway	Moderate: wetness.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Moderate: large stones.
OsB---------- Onaway	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action, shrink-swell.	Moderate: large stones.
OvC*:						
Onaway----------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
Kiva----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty.
Menahga----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: too sandy.
OvD*:						
Onaway----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kiva----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Menahga----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, too sandy.
PaB---------- Padus	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: large stones, droughty.
PaC---------- Padus	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, droughty, slope.

See footnote at end of table.

TABLE 11.--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
PaD---------- Padus	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
PeA---------- Pelkie	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
PkB---------- Pence	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: large stones, droughty.
PkC---------- Pence	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
PkD---------- Pence	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
PsD*: Peshekee---------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.
Rock outcrop.						
Pt*. Pits						
RsB---------- Rousseau	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty.
Sb*: Saprists.						
Aquents.						
Sd*: Seelyeville------	Severe: excess humus, ponding.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, excess humus.
Markey----------	Severe: cutbanks cave, excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
SfB---------- Shawano	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
SfC---------- Shawano	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
SfD---------- Shawano	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--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
ShA---------- Shiocton	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
SoA---------- Solona	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
SpB*: Solona----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
Onaway----------	Moderate: wetness.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Moderate: large stones.
SuB---------- Summerville	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
SuE---------- Summerville	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.
TlB---------- Tilleda	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Moderate: large stones.
TlC2---------- Tilleda	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: large stones, slope.
WaA---------- Wainola	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Wd---------- Waupaca	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding, frost action.	Severe: ponding, flooding.
Wf---------- Winterfield	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
WrA---------- Worcester	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AaE---- Alpena	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
BnA---- Bonduel	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Poor: depth to rock, wetness.
Bs---- Brevort	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
Co---- Cormant	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Es---- Ensley	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
FpB---- Fairport	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
FpC---- Fairport	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
FsB---- Fence	Severe: percs slowly.	Moderate: slope.	Slight----	Slight----	Good.
FsC---- Fence	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
IsA---- Iosco	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
KaB---- Kennan	Slight----	Severe: seepage.	Severe: seepage.	Slight----	Fair: large stones, thin layer.
KaC---- Kennan	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Fair: large stones, slope, thin layer.
KaD---- Kennan	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
KeB---- Keweenaw	Slight----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.

TABLE 12.--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
KeC---------- Keweenaw	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
KeD---------- Keweenaw	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
KvB---------- Kiva	Severe*: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
KvC---------- Kiva	Severe*: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
KvD---------- Kiva	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Lx---------- Loxley	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
McB---------- Mancelona	Severe*: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
McC---------- Mancelona	Severe*: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
MnB---------- Menahga	Severe*: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MnC---------- Menahga	Severe*: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MnD---------- Menahga	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
MoB---------- Menominee	Slight----------	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: too sandy.
MoC---------- Menominee	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: too sandy.
MoD---------- Menominee	Severe: slope.	Severe: seepage, slope.	Severe: too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope.

See footnotes at end of table.

TABLE 12.--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
Mu Minocqua	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
NeB Nester	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
OcB Oconto	Severe*: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
OcC Oconto	Severe*: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
OcD Oconto	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
OeB Onaway	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: large stones.
OeC2 Onaway	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: large stones, slope.
OeD2, OeE Onaway	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
OmB Onaway	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: large stones, wetness.
OsB Onaway	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey, thin layer.
OvC**: Onaway	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: large stones, slope.
Kiva	Severe*: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Menahga	Severe*: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
OvD**: Onaway	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnotes at end of table.

TABLE 12.--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
OvD**: Kiva	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Menahga	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
PaB Padus	Severe*: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
PaC Padus	Severe*: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
PaD Padus	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
PeA Pelkie	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
PkB Pence	Severe*: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
PkC Pence	Severe*: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
PkD Pence	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
PsD**: Peshekee	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
Rock outcrop.					
Pt**. Pits					
RsB Rousseau	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.

See footnotes at end of table.

TABLE 12.--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
Sb**:					
Saprists.					
Aquents.					
Sd**:					
Seelyeville	Severe: ponding, subsides.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Markey	Severe: ponding, percs slowly, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
SfB	Severe*:	Severe:	Severe:	Severe:	Poor:
Shawano	poor filter.	seepage.	seepage, too sandy.	seepage.	seepage, too sandy.
SfC	Severe*:	Severe:	Severe:	Severe:	Poor:
Shawano	poor filter.	seepage, slope.	seepage, too sandy.	seepage.	seepage, too sandy.
SfD	Severe:	Severe:	Severe:	Severe:	Poor:
Shawano	poor filter, slope.	seepage, slope.	seepage, slope, too sandy.	seepage, slope.	seepage, too sandy, slope.
ShA	Severe:	Severe:	Severe:	Severe:	Poor:
Shiocton	wetness.	wetness.	wetness, too sandy.	wetness.	wetness.
SoA	Severe:	Severe:	Severe:	Severe:	Poor:
Solona	wetness.	wetness.	wetness.	wetness.	wetness.
SpB**:					
Solona	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Onaway	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: large stones, wetness.
SuB	Severe:	Severe:	Severe:	Severe:	Poor:
Summerville	depth to rock.	depth to rock, large stones.	depth to rock, large stones.	depth to rock.	depth to rock, large stones.
SuE	Severe:	Severe:	Severe:	Severe:	Poor:
Summerville	depth to rock, slope.	depth to rock, slope, large stones.	depth to rock, slope, large stones.	depth to rock, slope.	depth to rock, large stones, slope.
TlB	Moderate:	Moderate:	Moderate:	Slight	Fair:
Tilleda	percs slowly.	seepage, slope.	too clayey.		too clayey, small stones.
TlC2	Moderate:	Severe:	Moderate:	Moderate:	Fair:
Tilleda	percs slowly, slope.	slope.	slope, too clayey.	slope.	too clayey, slope, small stones.

See footnotes at end of table.

TABLE 12.--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
WaA---------- Wainola	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.
Wd---------- Waupaca	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too sandy.	Severe: flooding, ponding.	Poor: ponding.
Wf---------- Winterfield	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
WrA---------- Worcester	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.

* The poor filtering capacity can result in the pollution of ground water.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AaE Alpena	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
BnA Bonduel	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones, thin layer.
Bs Brevort	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Co Cormant	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Es Ensley	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
FpB, FpC Fairport	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
FsB Fence	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
FsC Fence	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
IsA Iosco	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
KaB, KaC Kennan	Good	Probable	Probable	Poor: large stones, area reclaim.
KaD Kennan	Fair: slope.	Probable	Probable	Poor: large stones, area reclaim, slope.
KeB, KeC Keweenaw	Good	Probable	Probable	Poor: small stones, area reclaim.
KeD Keweenaw	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
KvB, KvC Kiva	Good	Probable	Probable	Poor: small stones, area reclaim.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
KvD Kiva	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Lx Loxley	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness, too acid.
McB, McC Mancelona	Good	Probable	Probable	Poor: small stones, area reclaim.
MnB, MnC Menahga	Good	Probable	Improbable: too sandy.	Poor: too sandy.
MnD Menahga	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
MoB, MoC Menominee	Good	Improbable: thin layer.	Improbable: excess fines.	Poor: thin layer.
MoD Menominee	Fair: slope.	Improbable: thin layer.	Improbable: excess fines.	Poor: thin layer.
Mu Minocqua	Poor: wetness.	Probable	Probable	Poor: small stones, area reclaim.
NeB Nester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
OcB, OcC Oconto	Good	Probable	Probable	Poor: small stones, area reclaim.
OcD Oconto	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
OeB, OeC2 Onaway	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.
OeD2 Onaway	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, slope.
OeE Onaway	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, slope.
OmB Onaway	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
OsB Onaway	Good	Probable	Probable	Poor: large stones, area reclaim.
OvC*: Onaway	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.
Kiva	Good	Probable	Probable	Poor: small stones, area reclaim.
Menahga	Good	Probable	Improbable: too sandy.	Poor: too sandy.
OvD*: Onaway	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, slope.
Kiva	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Menahga	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
PaB, PaC Padus	Good	Probable	Probable	Poor: small stones, area reclaim.
PaD Padus	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
PeA Pelkie	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
PkB, PkC Pence	Good	Probable	Probable	Poor: small stones, area reclaim.
PkD Pence	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
PsD*: Peshekee	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
Rock outcrop.				

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pt*. Pits				
RsB---------- Rousseau	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy.
Sb*: Saprists.				
Aquents.				
Sd*: Seelyeville----------	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Markey----------	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: excess humus, wetness.
SfB, SfC---------- Shawano	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
SfD---------- Shawano	Fair: slope.	Probable----------	Improbable: too sandy.	Poor: too sandy, slope.
ShA---------- Shiocton	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
SoA---------- Solona	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
SpB*: Solona----------	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Onaway----------	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.
SuB---------- Summerville	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, large stones.
SuE---------- Summerville	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, large stones, slope.
TlB, TlC2---------- Tilleda	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
WaA---------- Wainola	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wd---------- Waupaca	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Wf---------- Winterfield	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: wetness.
WrA---------- Worcester	Fair: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AaE---------- Alpena	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
BnA---------- Bonduel	Moderate: seepage, depth to rock.	Severe: thin layer, wetness.	Depth to rock, frost action.	Wetness, depth to rock.	Depth to rock, wetness.	Wetness, depth to rock.
Bs---------- Brevort	Severe: seepage.	Severe: piping, ponding.	Ponding, frost action.	Ponding, droughty, fast intake.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily, droughty.
Co---------- Cormant	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
Es---------- Ensley	Severe: seepage.	Severe: piping, ponding.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
FpB---------- Fairport	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, soil blowing, depth to rock.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
FpC---------- Fairport	Severe: slope.	Severe: thin layer.	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
FsB---------- Fence	Moderate: slope.	Severe: piping.	Deep to water	Slope, soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
FsC---------- Fence	Severe: slope.	Severe: piping.	Deep to water	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
IsA---------- Iosco	Severe: seepage.	Severe: piping, wetness.	Frost action---	Wetness, droughty, fast intake.	Wetness, soil blowing.	Wetness, droughty.
KaB---------- Kennan	Moderate: seepage, slope.	Severe: piping.	Deep to water	Droughty, soil blowing, slope.	Large stones, soil blowing.	Large stones, droughty.
KaC, KaD---------- Kennan	Severe: slope.	Severe: piping.	Deep to water	Droughty, soil blowing, slope.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
KeB---------- Keweenaw	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Large stones, too sandy.	Large stones, droughty.
KeC, KeD---------- Keweenaw	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, too sandy.	Large stones, slope, droughty.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
KvB---------- Kiva	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Large stones, too sandy.	Large stones, droughty.
KvC, KvD---------- Kiva	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Lx---------- Loxley	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides, frost action.	Ponding, too acid.	Not needed-----	Not needed.
McB---------- Mancelona	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
McC---------- Mancelona	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
MnB---------- Menahga	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
MnC, MnD---------- Menahga	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
MoB---------- Menominee	Severe: seepage.	Severe: piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
MoC, MoD---------- Menominee	Severe: seepage, slope.	Severe: piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Mu---------- Minocqua	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, frost action.	Ponding, droughty, soil blowing.	Erodes easily, ponding, too sandy.	Wetness, erodes easily, droughty.
NeB---------- Nester	Moderate: slope.	Moderate: piping.	Deep to water	Slope----------	Favorable------	Favorable.
OcB---------- Oconto	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
OcC, OcD---------- Oconto	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
OeB---------- Onaway	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Large stones, soil blowing.	Large stones.
OeC2, OeD2, OeE--- Onaway	Severe: slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope.
OmB---------- Onaway	Moderate: slope.	Severe: piping.	Slope----------	Soil blowing, wetness, slope.	Large stones, wetness.	Large stones.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
OsB---------- Onaway	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, rooting depth, slope.	Large stones, soil blowing.	Large stones, rooting depth.
OvC*, OvD*: Onaway----------	Severe: slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope.
Kiva----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Menahga----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
PaB---------- Padus	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
PaC, PaD---------- Padus	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
PeA---------- Pelkie	Severe: seepage.	Severe: seepage, piping.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
PkB---------- Pence	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
PkC, PkD---------- Pence	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
PsD*: Peshekee----------	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, droughty, soil blowing.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.
Rock outcrop.						
Pt*. Pits						
RsB---------- Rousseau	Severe: seepage.	Severe: seepage, piping.	Slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.
Sb*: Saprists.						
Aquents.						
Sd*: Seelyeville------	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Sd*:						
Markey	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
SfB Shawano	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
SfC, SfD Shawano	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
ShA Shiocton	Moderate: seepage.	Severe: piping, wetness.	Frost action, cutbanks cave.	Wetness, soil blowing.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily.
SoA Solona	Moderate: seepage.	Severe: piping, wetness.	Frost action---	Wetness, droughty, soil blowing.	Wetness, soil blowing.	Wetness, droughty.
SpB*:						
Solona	Moderate: seepage.	Severe: piping, wetness.	Frost action---	Wetness, droughty, soil blowing.	Wetness, soil blowing.	Wetness, droughty.
Onaway	Moderate: slope.	Severe: piping.	Slope	Soil blowing, wetness, slope.	Large stones, wetness.	Large stones.
SuB Summerville	Severe: depth to rock.	Severe: piping, large stones.	Deep to water	Large stones, droughty, soil blowing.	Large stones, depth to rock.	Large stones, droughty.
SuE Summerville	Severe: depth to rock, slope.	Severe: piping, large stones.	Deep to water	Large stones, droughty, soil blowing.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
TlB Tilleda	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.
TlC2 Tilleda	Severe: slope.	Moderate: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
WaA Wainola	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Wd Waupaca	Slight	Severe: piping, ponding.	Ponding, flooding, frost action.	Ponding, soil blowing, flooding.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily.
Wf Winterfield	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
WrA Worcester	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty, rooting depth.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--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	
AaE---------- Alpena	0-8	Gravelly sandy loam.	SM, ML, SP-SM, GM	A-2-4, A-4, A-1, A-3	0-15	50-85	40-85	20-85	5-70	<25	NP-7
	8-60	Stratified very gravelly sand to sand.	SP, SP-SM, GP, GW	A-1	0-15	35-60	25-50	10-35	0-10	---	NP
BnA---------- Bonduel	0-8	Loam----------	ML, CL, CL-ML	A-4	0	90-100	90-100	80-100	50-95	20-30	3-10
	8-14	Loam, silt loam	CL, CL-ML	A-4, A-6	0-2	90-100	90-100	80-100	50-95	20-30	5-12
	14-25	Sandy clay loam, loam, silt loam.	CL, SC	A-4, A-6	0-5	90-100	90-100	75-100	35-90	25-40	7-20
	25-37	Loam, fine sandy loam, sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-2, A-1	0-5	70-95	70-95	40-90	20-70	<30	NP-12
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bs---------- Brevort	0-9	Mucky loamy sand	SP, SM, SP-SM	A-2-4, A-3	0-5	90-100	80-100	50-75	0-30	---	NP
	9-35	Sand, loamy sand, loamy fine sand.	SP, SM, SP-SM	A-2-4, A-3	0-5	90-100	80-100	50-75	0-30	<20	NP-4
	35-60	Silt loam, clay loam, loam.	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	80-100	80-100	55-95	17-45	4-22
Co---------- Cormant	0-9	Loamy fine sand	SM, SP-SM	A-2, A-4, A-3	0	100	100	80-100	5-40	---	NP
	9-60	Fine sand, sand, loamy fine sand.	SP, SP-SM, SM	A-2, A-3	0	100	100	70-100	1-20	---	NP
Es---------- Ensley	0-7	Mucky loam-------	ML, CL-ML	A-4	0-10	90-100	85-100	75-90	50-65	<25	NP-6
	7-27	Sandy loam, silt loam, fine sandy loam.	SC, SM-SC	A-6, A-4, A-2	0-10	85-100	85-100	55-95	25-50	20-30	6-16
	27-60	Sandy loam, fine sandy loam.	SM-SC, SM	A-2, A-4	0-10	70-95	70-95	50-75	20-40	<20	NP-7
FpB, FpC--------- Fairport	0-14	Fine sandy loam	SM, SM-SC, SC	A-4, A-2	0-2	85-95	75-95	45-85	25-50	<20	NP-10
	14-34	Loam, sandy loam	ML, CL, SM, SC	A-2, A-4, A-6	0-15	85-100	80-100	60-95	30-70	<30	2-15
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
FsB, FsC--------- Fence	0-7	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-65	<25	NP-7
	7-13	Silt loam, very fine sandy loam, loamy very fine sand.	ML, CL, SM, SC	A-4	0	100	100	85-100	40-100	<30	NP-9
	13-33	Silt loam, very fine sandy loam, silt.	ML, CL-ML, CL	A-4	0	100	100	85-100	70-100	<30	NP-12
	33-60	Stratified silt to very fine sand.	ML, CL-ML	A-4	0	100	100	85-100	50-100	<25	NP-7

TABLE 15.--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	
IsA---------- Iosco	0-10	Loamy fine sand	SM, SC, ML, CL	A-4	0	100	100	70-85	40-55	19-28	2-9
	10-23	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-3, A-2	0	100	100	50-80	5-35	---	NP
	23-34	Loam, fine sandy loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	100	70-95	35-75	26-35	8-15
	34-60	Fine sandy loam, sandy loam, loam.	SC, SM-SC, CL, CL-ML	A-2, A-4	0-5	100	95-100	60-95	30-75	20-30	4-10
KaB, KaC, KaD---- Kennan	0-3	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4, A-1	0-25	75-100	75-100	45-85	20-55	<23	2-6
	3-19	Sandy loam, fine sandy loam, loam.	SM, SC, ML, CL	A-2, A-4, A-1	0-25	75-100	75-100	40-100	20-90	<30	NP-10
	19-48	Sandy loam, loam, loamy sand.	SM, SC, ML, CL	A-2, A-4, A-1	0-25	75-95	70-95	40-90	12-70	<30	NP-9
	48-60	Loamy sand, sandy loam, gravelly loamy sand.	SP-SM, SM, SM-SC	A-1-b, A-2	0-25	65-95	60-95	30-70	10-25	<20	NP-5
KeB, KeC, KeD---- Keweenaw	0-3	Loamy fine sand	SM, SC, SM-SC, SP-SM	A-2, A-1-b	0-10	80-100	80-100	45-85	10-30	<20	NP-10
	3-34	Loamy sand, loamy fine sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b	0-25	75-100	70-100	45-90	10-30	<20	NP-10
	34-50	Loamy sand, fine sandy loam, sandy loam.	SM, SC, SP, SM-SC	A-2, A-3, A-1-b	0-25	60-100	55-100	35-85	0-35	<30	NP-10
	50-60	Loamy sand, gravelly loamy sand.	SM, SC, SM-SC, SP-SM	A-2, A-1-b	0-25	60-100	50-100	30-85	10-30	<20	NP-10
KvB, KvC, KvD---- Kiva	0-15	Sandy loam-------	SM, SC, SM-SC, ML	A-2-4, A-4	0-10	85-100	80-95	50-90	30-70	<25	NP-10
	15-60	Gravelly sand, coarse sand, very gravelly sand.	SP-SM, SP, GP, GP-GM	A-1, A-3, A-2-4	15-40	50-90	40-80	20-60	0-10	---	NP
Lx---------- Loxley	0-6	Hemic material---	PT	A-8	0	---	---	---	---	---	---
	6-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
McB, McC--------- Mancelona	0-9	Loamy sand-------	SM, ML	A-2, A-1-b, A-4	0-5	90-100	65-95	40-90	15-55	---	NP
	9-26	Loamy sand, sand, gravelly loamy sand.	SM, SP-SM	A-2, A-1-b	0-5	90-100	65-95	40-80	10-30	---	NP
	26-30	Gravelly loamy sand, sandy clay loam, gravelly sandy loam.	SM, SM-SC, SC	A-2, A-4	0-5	85-100	60-95	50-70	15-45	12-30	NP-10
	30-60	Very gravelly sand, gravelly sand, coarse sand.	GP, SP, GW, SW	A-1	5-10	40-90	35-85	20-40	0-10	---	NP

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MnB, MnC, MnD---- Menahga	0-3	Sand----------	SP, SP-SM	A-3, A-2	0	100	85-100	50-75	0-10	---	NP
	3-34	Coarse sand, sand, loamy coarse sand.	SP, SP-SM	A-3, A-2, A-1	0	100	80-100	30-75	0-10	---	NP
	34-60	Coarse sand, sand	SP, SP-SM	A-3, A-2, A-1	0	100	80-100	30-75	0-10	---	NP
MoB, MoC, MoD---- Menominee	0-9	Loamy fine sand	SM	A-2, A-4	0	100	100	50-80	15-40	---	NP
	9-23	Fine sand, loamy fine sand, sand.	SM, ML, SP-SM	A-2, A-4, A-3	0	100	100	50-80	5-55	---	NP
	23-29	Clay loam, loam, sandy clay loam.	SC, SM, CL, ML	A-4, A-6	0	95-100	95-100	80-100	35-80	<30	NP-15
	29-60	Sandy loam, loam, silt loam.	SC, SM, CL, ML	A-4, A-6, A-2	0	85-100	80-100	60-95	30-75	<30	NP-12
Mu---------- Minocqua	0-10	Mucky fine sandy loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0-7	80-100	75-100	45-85	25-55	<20	2-7
	10-36	Silt loam, loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-2, A-4, A-6	0-7	80-100	75-100	45-100	25-90	20-35	4-13
	36-60	Gravelly coarse sand, sand, gravelly sand.	SP, SM, GP, GM	A-1, A-3, A-2	0-7	35-100	30-100	5-70	0-30	---	NP
NeB---------- Nester	0-9	Silt loam--------	ML, CL	A-4, A-6	0-5	95-100	95-100	80-100	55-80	25-40	2-15
	9-24	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0-5	95-100	95-100	80-100	65-100	35-60	15-30
	24-60	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	95-100	90-100	65-100	30-45	10-25
OcB, OcC, OcD---- Oconto	0-9	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	80-100	75-100	45-85	25-55	<23	2-7
	9-33	Fine sandy loam, sandy loam, loam.	ML, CL, SM, SC	A-2, A-4	0	80-100	75-100	45-95	25-75	<28	3-9
	33-60	Sand, gravelly sand, sand and gravel.	SP, SP-SM, GP, GP-GM	A-1, A-2, A-3	0-3	45-100	40-95	20-65	2-12	---	NP
OeB, OeC2, OeD2, OeE---------- Onaway	0-14	Fine sandy loam	SM, SM-SC, SC	A-2, A-4	0-10	90-100	85-95	55-80	25-50	<20	NP-10
	14-25	Loam, clay loam, silty clay loam.	CL, SC	A-4, A-6	0-20	85-100	80-100	80-95	40-90	25-35	7-15
	25-60	Silt loam, loam, sandy loam.	CL-ML, SC, CL, SM-SC	A-4, A-2	0-20	75-95	65-95	50-95	25-80	15-25	NP-10
OmB---------- Onaway	0-10	Fine sandy loam	SM, SM-SC, SC	A-2, A-4	0-10	90-100	85-95	55-80	25-50	<20	NP-10
	10-31	Loam, clay loam, sandy loam.	CL, SC	A-4, A-6	0-20	85-100	80-100	80-95	40-90	25-35	7-15
	31-60	Silt loam, loam, sandy loam.	CL-ML, SC, CL, SM-SC	A-4, A-6	0-20	90-100	85-100	60-95	36-80	<30	2-15
OsB---------- Onaway	0-10	Fine sandy loam	SM, SM-SC, SC	A-4	0-30	90-100	85-95	70-80	40-50	<20	NP-10
	10-23	Fine sandy loam, sandy loam, loam.	SM, SC, ML, CL	A-4, A-2	0-30	90-100	85-100	60-90	30-70	<25	NP-10
	23-42	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-20	95-100	95-100	80-95	65-90	25-35	7-15
	42-60	Loamy fine sand, fine sand, sand and gravel.	SP, SM, GP, GM	A-1, A-2, A-3, A-4	0-5	45-100	40-100	15-80	2-50	---	NP

TABLE 15.--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	
OvC*, OvD*:											
Onaway----------	0-14	Fine sandy loam	SM, SM-SC, SC	A-2, A-4	0-10	90-100	85-95	55-80	25-50	<20	NP-10
	14-25	Loam, clay loam, silty clay loam.	CL, SC	A-4, A-6	0-20	85-100	80-100	80-95	40-90	25-35	7-15
	25-60	Silt loam, loam, sandy loam.	CL-ML, SC, CL, SM-SC	A-4	0-20	90-95	85-95	60-95	36-80	15-25	4-10
Kiva----------	0-15	Sandy loam-------	SM, SC, SM-SC, ML	A-2-4, A-4	0-10	85-100	80-95	50-90	30-70	<25	NP-10
	15-60	Gravelly sand, coarse sand, very gravelly sand.	SP-SM, SP, GP, GP-GM	A-1, A-3, A-2-4	15-40	50-90	40-80	20-60	0-10	---	NP
Menahga---------	0-3	Sand-------------	SP, SP-SM	A-3, A-2	0	100	85-100	50-75	0-10	---	NP
	3-34	Coarse sand, sand, loamy coarse sand.	SP, SP-SM	A-3, A-2, A-1	0	100	80-100	30-75	0-10	---	NP
	34-60	Coarse sand, sand	SP, SP-SM	A-3, A-2, A-1	0	100	80-100	30-75	0-10	---	NP
PaB, PaC, PaD---- Padus	0-3	Fine sandy loam	SM	A-2, A-4, A-1-b	0-7	80-100	75-100	45-85	20-50	<25	NP-4
	3-26	Fine sandy loam, sandy loam, loam.	SM, SC, ML, CL	A-2, A-4, A-1-b	0-7	80-100	75-100	45-95	20-90	<30	NP-10
	26-31	Gravelly loamy sand, sand, gravelly sandy loam.	SM, SP, GP, GM	A-2, A-4, A-1, A-3	0-7	50-100	45-100	25-75	2-40	<25	NP-4
	31-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1, A-2, A-3	0-7	30-100	25-100	10-70	1-12	---	NP
PeA---------- Pelkie	0-2	Loamy fine sand	ML, SM	A-2, A-4	0	100	100	50-95	20-60	---	NP
	2-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
PkB, PkC, PkD---- Pence	0-2	Sandy loam-------	SM, ML	A-4, A-2, A-1	0-7	85-100	75-100	45-85	20-55	<21	NP-4
	2-18	Sandy loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2, A-1	0-7	55-100	50-100	30-95	15-75	<25	NP-7
	18-23	Gravelly coarse sand, loamy sand, sand.	SM, SP-SM, GM, GP-GM	A-2, A-1	0-8	55-100	50-100	25-75	10-30	---	NP
	23-60	Gravelly coarse sand, sand, sand and gravel.	SP, SM, GP, GM	A-1, A-3, A-2	0-15	50-100	50-100	25-70	2-20	---	NP
PsD*:											
Peshekee--------	0-3	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-2-4, A-4, A-1-b	0-20	95-100	75-100	45-95	20-65	<20	NP-5
	3-17	Silt loam, very fine sandy loam, fine sandy loam.	SM, ML, CL-ML, SM-SC	A-2-4, A-4, A-1-b	0-20	95-100	75-100	45-100	20-90	<25	NP-7
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Pt*. Pits											
RsB---------- Rousseau	0-8	Fine sand--------	SP-SM, SM	A-2-4, A-3	0	100	100	90-100	5-35	---	NP
	8-32	Fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	100	100	90-100	5-35	---	NP
	32-60	Fine sand, sand	SP, SP-SM, SM	A-3, A-2-4	0	100	100	85-100	0-15	---	NP
Sb*: Saprists.											
Aquents.											
Sd*: Seelyeville-----	0-8	Sapric material	PT	A-8	0	---	---	---	---	---	---
	8-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
Markey----------	0-37	Sapric material	PT	A-8	---	---	---	---	---	---	---
	37-60	Sand, loamy sand, fine sand.	SP, SM, SP-SM	A-2, A-3	0	100	75-100	60-75	0-20	---	NP
SfB, SfC, SfD---- Shawano	0-4	Fine sand--------	SM	A-2	0	95-100	95-100	65-100	20-35	---	NP
	4-29	Fine sand--------	SM, SP-SM	A-2, A-3	0	95-100	95-100	65-100	5-35	---	NP
	29-60	Fine sand, very fine sand, sand.	SP, SM, SP-SM, ML	A-2, A-3, A-1, A-4	0	95-100	95-100	45-100	2-55	---	NP
ShA---------- Shiocton	0-9	Very fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	75-95	45-65	<25	2-7
	9-37	Silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-95	<30	NP-10
	37-60	Stratified silt to very fine sand.	ML, CL-ML, CL	A-4	0	100	95-100	80-100	65-95	<28	NP-9
SoA---------- Solona	0-9	Fine sandy loam	SM, SM-SC	A-4, A-2	0-3	80-100	75-100	45-85	25-50	<20	2-7
	9-22	Fine sandy loam, sandy loam, loam.	CL, ML, SC, SM	A-2, A-4	0-3	80-100	75-100	45-100	25-80	20-30	3-10
	22-60	Loam, sandy loam, gravelly sandy loam.	ML, CL, SM, SC	A-2, A-4, A-1	0-3	75-100	60-100	35-95	20-75	<25	NP-10
SpB*: Solona----------	0-9	Fine sandy loam	SM, SM-SC	A-4, A-2	0-3	80-100	75-100	45-85	25-50	<20	2-7
	9-22	Fine sandy loam, sandy loam, loam.	CL, ML, SC, SM	A-2, A-4	0-3	80-100	75-100	45-100	25-80	20-30	3-10
	22-60	Loam, sandy loam, gravelly sandy loam.	ML, CL, SM, SC	A-2, A-4, A-1	0-3	75-100	60-100	35-95	20-75	<25	NP-10
Onaway----------	0-10	Fine sandy loam	SM, SM-SC, SC	A-2, A-4	0-10	90-100	85-95	55-80	25-50	<20	NP-10
	10-31	Loam, clay loam, sandy loam.	CL, SC	A-4, A-6	0-20	85-100	80-100	80-95	40-90	25-35	7-15
	31-60	Silt loam, loam, sandy loam.	CL-ML, SC, CL, SM-SC	A-4, A-6	0-20	90-100	85-100	60-95	36-80	<30	2-15

See footnote at end of table.

TABLE 15.--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	
SuB, SuE--------- Summerville	0-8	Fine sandy loam	SM, SC, CL, ML	A-2-4, A-4	0-10	95-100	95-100	55-85	25-55	<30	NP-10
	8-15	Sandy loam, loam, angular cobbly sandy loam.	SM, SC, CL, ML	A-2-4, A-4	0-50	95-100	95-100	55-90	25-55	<30	NP-10
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
T1B, T1C2-------- Tilleda	0-16	Fine sandy loam	SM, CL-ML, ML, SM-SC	A-4	0-8	95-100	85-100	60-85	35-55	20-30	2-7
	16-34	Loam, sandy clay loam, clay loam.	CL, SC	A-4, A-2, A-6, A-7	0-8	95-100	85-100	70-100	30-75	25-50	9-30
	34-38	Loam, clay loam	CL	A-4, A-6, A-7	0-8	95-100	85-100	75-100	50-80	25-50	7-30
	38-60	Loam, clay loam, gravelly sandy loam.	CL, SC	A-4, A-6, A-7	0-8	95-100	60-100	50-95	40-80	22-50	7-30
WaA--------- Wainola	0-3	Loamy fine sand	SM	A-2-4	0	100	90-100	55-80	20-35	---	NP
	3-30	Fine sand, loamy fine sand.	SM	A-2-4	0	100	90-100	50-80	15-35	---	NP
	30-60	Fine sand, loamy fine sand, very fine sand.	SM	A-2-4	0	100	90-100	50-80	15-35	---	NP
Wd--------- Waupaca	0-9	Very fine sandy loam.	ML	A-4	0	100	100	85-95	50-65	<20	NP-4
	9-60	Silt loam---------	ML, CL-ML, CL	A-4	0	100	100	95-100	90-100	<28	NP-9
Wf--------- Winterfield	0-4	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	100	95-100	70-90	30-40	<20	NP-5
	4-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2-4, A-3, A-4	0	100	95-100	50-90	5-45	---	NP
WrA--------- Worcester	0-4	Loam----------	ML, CL, SM, SC	A-4	0-7	80-100	75-100	65-100	45-90	20-30	3-10
	4-28	Loam, sandy loam, silt loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0-7	80-100	75-100	35-95	12-80	<20	2-7
	28-60	Sand, gravelly sand, very gravelly sand.	SP, SP-SM, GP, GP-GM	A-1, A-2, A-3	0-7	30-100	25-100	10-70	1-12	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
AaE----------	0-8	5-15	1.25-1.55	2.0-20	0.05-0.17	6.6-7.8	Low----------	0.17	2	8	2-4
Alpena	8-60	0-10	1.25-1.65	>20	0.02-0.04	7.9-8.4	Low----------	0.10			
BnA----------	0-8	7-20	1.35-1.55	0.6-2.0	0.19-0.24	6.6-7.8	Low----------	0.32	4	5	2-3
Bonduel	8-14	5-20	1.45-1.55	0.6-2.0	0.16-0.22	6.6-7.8	Low----------	0.32			
	14-25	18-35	1.55-1.65	0.6-2.0	0.15-0.22	6.6-7.8	Moderate-----	0.32			
	25-37	2-25	1.65-1.70	0.6-2.0	0.09-0.18	6.6-8.4	Low----------	0.32			
	37	---	---	---	---	---	----------	----			
Bs----------	0-9	3-15	1.35-1.50	6.0-20	0.10-0.20	5.6-7.8	Low----------	0.17	5	2	4-16
Brevort	9-35	2-15	1.40-1.55	6.0-20	0.06-0.11	6.1-7.8	Low----------	0.17			
	35-60	10-35	1.45-1.95	0.2-0.6	0.14-0.22	7.4-8.4	Moderate-----	0.43			
Co----------	0-9	3-10	1.30-1.50	6.0-20	0.08-0.12	6.1-7.3	Low----------	0.17	5	2	4-16
Cormant	9-60	0-5	1.50-1.70	6.0-20	0.06-0.10	6.1-7.8	Low----------	0.17			
Es----------	0-7	10-18	1.30-1.60	2.0-6.0	0.17-0.22	6.1-7.8	Low----------	0.32	5	5	4-7
Ensley	7-27	10-25	1.30-1.70	0.6-2.0	0.10-0.18	6.6-8.4	Moderate-----	0.20			
	27-60	8-18	1.45-1.70	2.0-6.0	0.08-0.12	7.4-8.4	Low----------	0.20			
FpB, FpC-----	0-14	10-20	1.35-1.50	0.6-2.0	0.13-0.18	5.6-7.8	Low----------	0.24	4	3	1-3
Fairport	14-34	5-25	1.45-1.70	0.6-2.0	0.10-0.20	7.4-8.4	Low----------	0.37			
	34	---	---	---	---	---	----------	----			
FsB, FsC-----	0-7	5-15	1.20-1.35	0.6-2.0	0.20-0.22	3.6-6.5	Low----------	0.37	5	3	.5-1
Fence	7-13	5-18	1.50-1.60	0.2-0.6	0.11-0.22	3.6-6.5	Low----------	0.37			
	13-33	8-18	1.50-1.60	0.2-0.6	0.17-0.22	3.6-6.5	Low----------	0.37			
	33-60	5-15	1.50-1.60	0.2-0.6	0.17-0.22	4.5-7.8	Low----------	0.37			
IsA----------	0-10	5-15	1.35-1.70	2.0-6.0	0.10-0.13	5.1-7.3	Low----------	0.17	5	2	2-4
Iosco	10-23	2-5	1.45-1.60	6.0-20	0.06-0.11	5.1-7.3	Low----------	0.17			
	23-34	15-25	1.55-1.65	0.6-2.0	0.15-0.19	7.4-8.4	Low----------	0.32			
	34-60	10-20	1.30-1.70	0.6-2.0	0.10-0.19	7.9-8.4	Low----------	0.24			
KaB, KaC, KaD----	0-3	5-12	1.20-1.60	0.6-2.0	0.09-0.18	4.5-7.3	Low----------	0.24	5	3	1-3
Kennan	3-19	5-18	1.55-1.70	0.6-2.0	0.08-0.22	4.5-7.3	Low----------	0.24			
	19-48	5-18	1.55-1.70	0.6-2.0	0.04-0.18	4.5-7.3	Low----------	0.24			
	48-60	3-10	1.55-1.70	0.6-6.0	0.04-0.13	5.1-7.3	Low----------	0.17			
KeB, KeC, KeD----	0-3	2-15	1.10-1.60	2.0-6.0	0.09-0.12	4.5-6.5	Low----------	0.17	5	2	.5-2
Keweenaw	3-34	2-15	1.25-1.70	2.0-6.0	0.08-0.11	4.5-6.5	Low----------	0.17			
	34-50	0-15	1.25-1.60	0.6-6.0	0.06-0.14	4.5-6.5	Low----------	0.17			
	50-60	2-15	1.20-1.50	2.0-6.0	0.04-0.10	5.1-7.3	Low----------	0.17			
KvB, KvC, KvD----	0-15	10-18	1.20-1.60	0.6-2.0	0.08-0.18	6.1-7.8	Low----------	0.20	3	3	.5-2
Kiva	15-60	0-5	1.50-1.70	>20	0.02-0.04	7.9-8.4	Low----------	0.10			
Lx----------	0-6	---	0.30-0.40	2.0-6.0	0.45-0.55	<4.5	----------	----	2	5	70-90
Loxley	6-60	---	0.10-0.35	2.0-6.0	0.35-0.45	<4.5	----------	----			
McB, McC----------	0-9	0-10	1.15-1.60	2.0-6.0	0.10-0.12	5.6-7.3	Low----------	0.17	4	2	.5-2
Mancelona	9-26	0-15	1.25-1.50	6.0-20	0.06-0.12	5.6-7.8	Low----------	0.17			
	26-30	10-25	1.25-1.60	2.0-6.0	0.06-0.16	6.1-7.8	Low----------	0.17			
	30-60	0-10	1.20-1.50	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
MnB, MnC, MnD----	0-3	0-8	1.40-1.65	6.0-20	0.07-0.09	4.5-6.5	Low----------	0.15	5	1	.5-1
Menahga	3-34	0-5	1.50-1.65	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	34-60	0-5	1.50-1.65	6.0-20	0.05-0.07	5.6-7.3	Low----------	0.15			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
MoB, MoC, MoD----	0-9	3-7	1.15-1.60	6.0-20	0.10-0.12	5.1-6.5	Low----------	0.17	5	2	.5-1
Menominee	9-23	2-5	1.25-1.60	6.0-20	0.06-0.08	5.1-6.5	Low----------	0.17			
	23-29	18-35	1.30-1.70	0.6-2.0	0.15-0.20	5.6-8.4	Moderate-----	0.32			
	29-60	10-20	1.30-1.70	0.6-2.0	0.11-0.19	5.6-8.4	Low----------	0.32			
Mu----------	0-10	5-10	1.20-1.65	0.6-2.0	0.12-0.15	4.5-7.8	Low----------	0.24	4	3	4-10
Minocqua	10-36	10-18	1.50-1.60	0.6-2.0	0.11-0.19	4.5-7.8	Low----------	0.37			
	36-60	0-3	1.75-1.85	>6.0	0.02-0.04	4.5-7.8	Low----------	0.10			
NeB----------	0-9	2-18	1.25-1.60	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.32	5	6	1-3
Nester	9-24	35-45	1.35-1.55	0.2-0.6	0.10-0.20	5.1-7.3	Moderate-----	0.32			
	24-60	35-45	1.30-1.65	0.2-0.6	0.14-0.20	7.9-8.4	Moderate-----	0.32			
OcB, OcC, OcD----	0-9	6-13	1.35-1.70	0.6-2.0	0.11-0.18	6.1-7.8	Low----------	0.24	4	3	1-2
Oconto	9-33	8-18	1.40-1.65	0.6-2.0	0.10-0.19	6.1-7.8	Low----------	0.24			
	33-60	0-3	1.50-1.80	>6.0	0.02-0.07	7.4-8.4	Low----------	0.15			
OeB, OeC2, OeD2,											
OeE----------	0-14	10-20	1.30-1.70	2.0-6.0	0.08-0.16	5.1-7.8	Low----------	0.24	5	3	1-3
Onaway	14-25	18-35	1.30-1.85	0.6-2.0	0.12-0.18	5.1-7.8	Low----------	0.32			
	25-60	5-25	1.30-1.70	0.6-2.0	0.10-0.20	7.4-8.4	Low----------	0.32			
OmB----------	0-10	10-20	1.30-1.70	2.0-6.0	0.08-0.16	5.1-7.8	Low----------	0.24	5	3	1-3
Onaway	10-31	18-35	1.30-1.85	0.2-0.6	0.12-0.18	5.1-7.8	Low----------	0.32			
	31-60	5-25	1.35-1.70	0.2-0.6	0.10-0.20	7.4-8.4	Low----------	0.32			
OsB----------	0-10	10-20	1.30-1.70	0.6-2.0	0.11-0.18	5.6-7.8	Low----------	0.24	5	3	1-3
Onaway	10-23	10-22	1.30-1.70	0.6-2.0	0.08-0.19	5.6-7.8	Low----------	0.32			
	23-42	18-35	1.30-1.85	0.6-2.0	0.12-0.18	5.6-7.8	Moderate-----	0.32			
	42-60	0-10	1.55-1.85	6.0-20	0.02-0.10	6.6-7.8	Low----------	0.15			
OvC*, OvD*:											
Onaway----------	0-14	10-20	1.30-1.70	2.0-6.0	0.08-0.16	5.1-7.8	Low----------	0.24	5	3	1-3
	14-25	18-35	1.30-1.85	0.6-2.0	0.12-0.18	5.1-7.8	Low----------	0.32			
	25-60	5-25	1.30-1.70	0.6-2.0	0.10-0.20	7.4-8.4	Low----------	0.32			
Kiva----------	0-15	10-18	1.20-1.60	0.6-2.0	0.08-0.18	6.1-7.8	Low----------	0.20	3	3	.5-2
	15-60	0-5	1.50-1.70	>20	0.02-0.04	7.9-8.4	Low----------	0.10			
Menahga---------	0-3	0-8	1.40-1.65	6.0-20	0.07-0.09	4.5-6.5	Low----------	0.15	5	1	.5-1
	3-34	0-5	1.50-1.65	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	34-60	0-5	1.50-1.65	6.0-20	0.05-0.07	5.6-7.3	Low----------	0.15			
PaB, PaC, PaD----	0-3	3-10	1.35-1.70	0.6-2.0	0.10-0.15	4.5-6.5	Low----------	0.24	4	3	1-2
Padus	3-26	5-18	1.40-1.65	0.6-2.0	0.09-0.22	4.5-6.5	Low----------	0.24			
	26-31	2-10	1.40-1.65	0.6-6.0	0.05-0.14	4.5-6.5	Low----------	0.10			
	31-60	0-3	1.55-1.80	>6.0	0.02-0.06	5.1-6.5	Low----------	0.10			
PeA----------	0-2	5-12	1.30-1.55	2.0-6.0	0.08-0.12	4.5-6.5	Low----------	0.24	5	2	1-2
Pelkie	2-60	0-10	1.25-1.65	6.0-20	0.05-0.09	4.5-6.5	Low----------	0.15			
PkB, PkC, PkD----	0-2	3-11	1.20-1.65	2.0-6.0	0.10-0.18	4.5-6.5	Low----------	0.24	3	3	1-3
Pence	2-18	2-12	1.35-1.45	2.0-6.0	0.10-0.15	4.5-6.0	Low----------	0.24			
	18-23	2-10	1.65-1.75	2.0-6.0	0.05-0.08	4.5-6.0	Low----------	0.10			
	23-60	0-4	1.35-1.80	>6.0	0.02-0.05	5.1-6.5	Low----------	0.10			
PsD*:											
Peshekee--------	0-3	2-10	1.10-1.60	0.6-2.0	0.09-0.22	4.5-6.0	Low----------	0.24	2	3	1-2
	3-17	2-15	1.20-1.60	0.6-2.0	0.08-0.22	4.5-6.0	Low----------	0.37			
	17	---	---	---	---	---	----------	----			
Rock outcrop.											

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Pt*. Pits											
RsB---------- Rousseau	0-8	0-10	1.30-1.55	6.0-20	0.07-0.09	4.5-7.3	Low----------	0.15	5	1	<1
	8-32	0-10	1.30-1.60	6.0-20	0.06-0.11	4.5-7.3	Low----------	0.15			
	32-60	0-10	1.50-1.65	6.0-20	0.05-0.07	5.1-6.5	Low----------	0.15			
Sb*:											
Saprists.											
Aquents.											
Sd*:											
Seelyeville-----	0-8	---	0.10-0.25	2.0-6.0	0.35-0.45	4.5-7.3	----------	----	2	2	>25
	8-60	---	0.10-0.25	2.0-6.0	0.35-0.45	4.5-7.3	----------	----			
Markey----------	0-37	---	0.15-0.45	2.0-6.0	0.35-0.45	5.6-7.8	----------	----	2	2	55-85
	37-60	0-10	1.40-1.65	6.0-20	0.03-0.08	6.1-8.4	Low----------	----			
SfB, SfC, SfD---- Shawano	0-4	2-5	1.00-1.35	6.0-20	0.08-0.10	4.5-7.3	Low----------	0.15	5	1	<1
	4-29	1-3	1.45-1.70	6.0-20	0.07-0.09	5.1-6.5	Low----------	0.15			
	29-60	1-3	1.50-1.70	6.0-20	0.05-0.08	5.6-7.8	Low----------	0.15			
ShA---------- Shiocton	0-9	5-15	1.20-1.70	0.6-2.0	0.16-0.22	6.1-7.8	Low----------	0.20	5	3	2-4
	9-37	5-18	1.45-1.65	0.6-2.0	0.17-0.22	6.6-8.4	Low----------	0.32			
	37-60	5-18	1.65-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.43			
SoA---------- Solona	0-9	5-20	1.35-1.70	0.6-2.0	0.10-0.18	6.6-7.8	Low----------	0.24	5	3	1-3
	9-22	12-18	1.45-1.65	0.6-2.0	0.09-0.19	6.6-7.8	Low----------	0.32			
	22-60	5-20	1.45-1.70	0.6-2.0	0.08-0.19	7.4-8.4	Low----------	0.32			
SpB*:											
Solona----------	0-9	5-20	1.35-1.70	0.6-2.0	0.10-0.18	6.6-7.8	Low----------	0.24	5	3	1-3
	9-22	12-18	1.45-1.65	0.6-2.0	0.09-0.19	6.6-7.8	Low----------	0.32			
	22-60	5-20	1.45-1.70	0.6-2.0	0.08-0.19	7.4-8.4	Low----------	0.32			
Onaway----------	0-10	10-20	1.30-1.70	2.0-6.0	0.08-0.16	5.1-7.8	Low----------	0.24	5	3	1-3
	10-31	18-35	1.30-1.85	0.2-0.6	0.12-0.18	5.1-7.8	Low----------	0.32			
	31-60	5-25	1.35-1.70	0.2-0.6	0.10-0.20	7.4-8.4	Low----------	0.32			
SuB, SuE--------- Summerville	0-8	10-18	1.30-1.60	2.0-6.0	0.08-0.18	6.1-7.8	Low----------	0.24	2	3	1-2
	8-15	10-25	1.35-1.65	0.6-2.0	0.06-0.16	6.1-8.4	Low----------	0.24			
	15	---	---	---	---	---	----------	----			
T1B, T1C2-------- Tilleda	0-16	8-14	1.35-1.55	0.6-2.0	0.13-0.18	5.1-7.3	Low----------	0.24	5	3	1-3
	16-34	18-30	1.55-1.65	0.6-2.0	0.12-0.19	5.1-7.3	Moderate-----	0.32			
	34-38	18-30	1.55-1.65	0.6-2.0	0.12-0.19	5.1-7.8	Moderate-----	0.32			
	38-60	15-30	1.60-1.70	0.6-2.0	0.07-0.19	5.1-7.8	Low----------	0.32			
WaA---------- Wainola	0-3	0-10	1.35-1.50	6.0-20	0.10-0.12	4.5-6.5	Low----------	0.15	5	2	2-4
	3-30	2-12	1.35-1.45	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.15			
	30-60	0-10	1.25-1.50	6.0-20	0.05-0.07	5.6-6.5	Low----------	0.15			
Wd---------- Waupaca	0-9	2-10	1.20-1.65	0.6-2.0	0.20-0.22	6.6-7.8	Low----------	0.32	5	3	2-6
	9-60	2-18	1.60-1.70	0.2-0.6	0.08-0.13	6.6-8.4	Low----------	0.43			
Wf---------- Winterfield	0-4	2-15	0.90-1.50	2.0-6.0	0.12-0.14	5.6-7.8	Low----------	0.20	5	3	2-4
	4-60	0-15	1.45-1.60	6.0-20	0.06-0.11	5.6-7.8	Low----------	0.17			
WrA---------- Worcester	0-4	7-15	1.35-1.55	0.6-2.0	0.16-0.24	4.5-6.5	Low----------	0.32	4	5	1-3
	4-28	8-18	1.40-1.70	0.6-2.0	0.09-0.22	4.5-6.5	Low----------	0.32			
	28-60	0-3	1.30-2.00	>6.0	0.02-0.07	5.1-6.5	Low----------	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "occasional," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Total subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness			Uncoated steel	Concrete
					Ft			In		In			
AaE---------- Alpena	A	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Low.
BnA---------- Bonduel	C	None--------	---	---	1.0-3.0	Apparent	Sep-Jun	20-40	Hard	---	High-----	Moderate	Low.
Bs---------- Brevort	B/D	None--------	---	---	+1-1.0	Apparent	Nov-May	>60	---	---	High-----	Low------	Moderate.
Co---------- Cormant	A/D	None--------	---	---	+1-1.0	Apparent	Jan-Dec	>60	---	---	Moderate	High-----	Low.
Es---------- Ensley	B/D	None--------	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	---	High-----	High-----	Low.
FpB, FpC-------- Fairport	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate	Low.
FsB, FsC-------- Fence	B	None--------	---	---	>6.0	---	---	>60	---	---	High-----	Low------	High.
IsA---------- Iosco	B	None--------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	High-----	High-----	Low.
KaB, KaC, KaD--- Kennan	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	High.
KeB, KeC, KeD--- Keweenaw	A	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Moderate.
KvB, KvC, KvD--- Kiva	A	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Low.
Lx---------- Loxley	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	>60	---	50-55	High-----	High-----	High.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Total subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness			Uncoated steel	Concrete
					Ft			In		In			
McB, McC--------- Mancelona	A	None---------	---	---	>6.0	---	---	>60	---	---	Low-------	Low-------	Low.
MnB, MnC, MnD--- Menahga	A	None---------	---	---	>6.0	---	---	>60	---	---	Low-------	Low-------	Moderate.
MoB, MoC, MoD--- Menominee	A	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	Moderate.
Mu--------------- Minocqua	B/D	None---------	---	---	+1-1.0	Apparent	Nov-May	>60	---	---	High------	High------	High.
NeB--------------- Nester	C	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	High------	Low.
OcB, OcC, OcD--- Oconto	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	Moderate.
OeB, OeC2, OeD2, OeE----------- Onaway	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	Moderate.
OmB--------------- Onaway	B	None---------	---	---	3.0-6.0	Apparent	Nov-May	>60	---	---	Moderate	Low-------	Moderate.
OsB--------------- Onaway	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	Moderate.
OvC*, OvD*: Onaway----------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	Moderate.
Kiva------------	A	None---------	---	---	>6.0	---	---	>60	---	---	Low-------	Low-------	Low.
Menahga----------	A	None---------	---	---	>6.0	---	---	>60	---	---	Low-------	Low-------	Moderate.
PaB, PaC, PaD--- Padus	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	High.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Total subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness			Uncoated steel	Concrete
					Ft			In		In			
PeA---------- Pelkie	A	Occasional	Brief-----	Mar-May	2.5-5.0	Apparent	Nov-May	>60	---	---	Low------	Low------	Moderate.
PkB, PkC, PkD--- Pence	B	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Moderate.
PsD*: Peshekee-------	D	None--------	---	---	>6.0	---	---	10-20	Hard	---	Moderate	Low------	High.
Rock outcrop.													
Pt*. Pits													
RsB---------- Rousseau	A	None--------	---	---	3.0-6.0	Apparent	Feb-May	>60	---	---	Low------	Low------	Moderate.
Sb*: Saprists.													
Aquents.													
Sd*: Seelyeville----	A/D	None--------	---	---	+1-1.0	Apparent	Jan-Dec	>60	---	50-55	High-----	High-----	Moderate.
Markey---------	A/D	None--------	---	---	+1-1.0	Apparent	Jan-Dec	>60	---	25-30	High-----	High-----	Low.
SfB, SfC, SfD--- Shawano	A	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	High.
ShA---------- Shiocton	C	None--------	---	---	1.0-3.0	Apparent	Sep-Jul	>60	---	---	High-----	Moderate	Low.
SoA---------- Solona	C	None--------	---	---	1.0-3.0	Apparent	Mar-Jul	>60	---	---	High-----	High-----	Low.
SpB*: Solona---------	C	None--------	---	---	1.0-3.0	Apparent	Mar-Jul	>60	---	---	High-----	High-----	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Total subsidence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness			Uncoated steel	Concrete
					Ft			In		In			
SpB*: Onaway	B	None	---	---	3.0-6.0	Apparent	Nov-May	>60	---	---	Moderate	Low	Moderate.
SuB, SuE: Summerville	D	None	---	---	>6.0	---	---	10-20	Hard	---	Moderate	Low	Low.
TlB, TlC2: Tilleda	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Low	Moderate.
WaA: Wainola	B	None	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	Moderate	Low	Moderate.
Wd: Waupaca	B/D	Frequent	Long	Mar-Jun	+1-1.0	Perched	Oct-May	>60	---	---	High	High	Low.
Wf: Winterfield	A/D	Frequent	Brief	Nov-May	0.5-1.5	Apparent	Nov-May	>60	---	---	Moderate	Low	Low.
WrA: Worcester	C	None	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	High	High	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

[Dashes indicate that data were not available. MAX means maximum dry density; OPT, optimum moisture; LL, liquid limit; PI, plasticity index; UN, Unified; and NP, nonplastic]

Soil name and location	Parent material	Report number	Depth	Moisture density		Percentage passing sieve*--				Percentage smaller than*--				LL	PI	Classification	
				MAX	OPT	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO	UN
			In	Lb/ft^3	Pct									Pct			
Bonduel loam: NE1/4NE1/4 sec. 17, T. 26 N., R. 19 E.	Loamy till over dolomite.	S83WI-083-1-1	9-16	---	---	92	91	86	50	46	37	25	19	28.0	11.8	A-6(4)	CL
		1-2	24-27	---	---	88	84	76	45	38	29	18	13	23.8	8.6	A-4(2)	ML
Ensley mucky loam: SW1/4SW1/4 sec. 8, T. 28 N., R. 19 E.	Calcareous loamy till.	S81WI-083-3-1	16-23	---	---	100	100	94	49	42	31	19	16	21.5	6.1	A-4(3)	SM-SC
		3-2	30-60	---	---	72	71	64	29	23	15	8	6	---	NP	A-2-4 (0)	SM
Fairport fine sandy loam**: NE1/4SW1/4 sec. 35, T. 29 N., R. 18 E.	Loamy till over dolomite.	S82WI-083-5-1	9-20	---	---	98	96	90	41	36	27	19	14	16.6	2.4	A-4(1)	SM
		5-2	20-33	---	---	92	91	85	44	40	34	25	20	29.6	14.6	A-6(2)	SC
Fairport fine sandy loam**: NE1/4SW1/4 sec. 4, T. 26 N., R. 19 E.	Loamy till over dolomite.	S80WI-083-1-1	10-17	---	---	100	100	94	54	46	30	14	9	---	NP	A-4(4)	ML
		1-2	17-21	---	---	100	100	95	57	52	40	26	19	28.7	13.1	A-6(6)	CL
Fence very fine sandy loam: NW1/2SE1/4 sec. 10, T. 29 N., R. 19 E.	Loamy glacio-lacustrine deposits.	S83WI-083-2-1	19-30	---	---	100	100	100	83	76	54	30	20	30.4	12.0	A-6(9)	CL
		2-2	30-60	110.1	14.9	100	100	100	90	74	22	5	3	---	NP	A-4(8)	ML
Fence very fine sandy loam: NE1/4NE1/4 sec. 19, T. 32 N., R. 17 E.	Loamy glacio-lacustrine deposits.	S82WI-083-2-3	31-36	112.5	14.0	100	100	100	74	61	30	12	10	---	NP	A-4(8)	ML
		2-4	36-60	106.6	15.2	100	100	100	81	64	20	4	3	---	NP	A-4(8)	ML

See footnotes at end of table.

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

Soil name and location	Parent material	Report number	Depth	Moisture density		Percentage passing sieve*--				Percentage smaller than*--				LL	PI	Classification	
				MAX	OPT	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO	UN
			In	Lb/ft^3	Pct									Pct			
Menominee loamy fine sand: NE1/4NW1/4 sec. 29, T. 29 N., R. 18 E.	Sandy outwash over loamy till or lacustrine deposits.	S77WI-083-3-1	27-34	---	---	100	100	96	53	47	38	27	21	26.0	11.0	A-6(4)	CL
		3-2	34-60	128.6	9.8	93	89	82	48	43	32	19	12	16.8	4.2	A-4(3)	SM-SC
Nester silt loam: NE1/4SW1/4 sec. 10, T. 29 N., R. 19 E.	Loamy or silty till.	S81WI-083-1-1	12-24	---	---	100	100	100	96	96	94	66	44	45.3	24.3	A-7-6 (15)	CL
		1-2	24-60	---	---	100	100	100	97	97	93	60	40	44.6	23.5	A-7-6 (14)	CL
Oconto fine sandy loam: NW1/4NW1/4 sec. 28, T. 29 N., R. 17 E.	Loamy deposits over sand or sand and gravel outwash.	S80WI-083-3-1	9-14	---	---	96	94	85	48	39	20	5	3	---	NP	A-4(3)	SM
		3-2	22-33	---	---	100	100	91	51	46	37	22	15	23.2	9.0	A-4(3)	CL
Onaway fine sandy loam**: NW1/4SE1/4 sec. 28, T. 29 N., R. 17 E.	Calcareous loamy till.	S78WI-083-3-1	16-23	---	---	97	96	90	47	44	37	28	23	29.4	14.2	A-6(4)	SC
		3-2	26-60	132.1	7.8	82	79	71	36	31	22	12	8	---	NP	A-4(0)	SM
Onaway fine sandy loam**: NW1/4SW1/4 sec. 10, T. 29 N., R. 20 E.	Calcareous loamy till.	S77WI-083-2-1	17-26	---	---	100	100	91	44	42	36	27	22	29.3	13.1	A-6(3)	SC
		2-2	26-60	137.7	6.7	77	67	53	26	22	15	8	5	---	NP	A-2-4 (0)	SM
Padus fine sandy loam: SW1/4NE1/4 sec. 33, T. 33 N., R. 15 E.	Loamy and sandy deposits over sand and gravel outwash.	S78WI-083-4-1	18-28	---	---	95	92	78	37	29	18	8	5	---	NP	A-4(0)	SM
		4-2	36-60	130.8	7.8	63	52	19	6	5	4	2	1	---	NP	A-1-b (0)	SP-SM

See footnotes at end of table.

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

Soil name and location	Parent material	Report number	Depth	Moisture density		Percentage passing sieve*--				Percentage smaller than*--				LL	PI	Classification	
				MAX	OPT	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO	UN
			In	Lb/ft^3	Pct									Pct			
Tilleda fine sandy loam: NE1/4NW1/4 sec. 7, T. 29 N., R. 17 E.	Loamy till.	S82WI-083-6-1	23-32	114.2	14.4	100	100	96	71	66	51	26	17	27.9	11.5	A-6(8)	CL
		6-2	39-60	120.3	11.8	98	98	93	70	65	50	22	12	22.4	7.8	A-4(7)	CL

* Mechanical analysis according to the AASHTO Designation T88-57 (1). Results from this procedure can differ somewhat from the results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculation of grain-size fractions. The mechanical analysis data given in this table are not suitable for use in naming textural classes of soils.

** The soil is a taxadjunct. See the series description for an explanation.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Alpena	Sandy-skeletal, mixed Udorthentic Haploborolls
Aquents	Sandy, mixed, frigid Aquents
Bonduel	Fine-loamy, mixed Aquic Eutroboralfs
Brevort	Sandy over loamy, mixed, nonacid, frigid Mollic Haplaquents
Cormant	Mixed, frigid Mollic Psammaquents
Ensley	Coarse-loamy, mixed, nonacid, frigid Aeric Haplaquepts
*Fairport	Fine-loamy, mixed Typic Eutroboralfs
Fence	Coarse-silty, mixed, frigid Alfic Haplorthods
Iosco	Sandy over loamy, mixed, frigid Alfic Haplaquods
*Kennan	Coarse-loamy, mixed Typic Glossoboralfs
Keweenaw	Sandy, mixed, frigid Alfic Haplorthods
Kiva	Sandy, mixed, frigid Entic Haplorthods
Loxley	Dysic Typic Borosaprists
Mancelona	Sandy, mixed, frigid Alfic Haplorthods
Markey	Sandy or sandy-skeletal, mixed, euic Terric Borosaprists
Menahga	Mixed, frigid Typic Udipsamments
Menominee	Sandy over loamy, mixed, frigid Alfic Haplorthods
Minocqua	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, frigid Typic Haplaquepts
Nester	Fine, mixed Typic Eutroboralfs
Oconto	Coarse-loamy, mixed Typic Eutroboralfs
*Onaway	Fine-loamy, mixed Typic Eutroboralfs
Padus	Coarse-loamy, mixed, frigid Alfic Haplorthods
Pelkie	Mixed, frigid Typic Udipsamments
Pence	Sandy, mixed, frigid Entic Haplorthods
*Peshekee	Loamy, mixed, frigid Lithic Haplorthods
Rousseau	Sandy, mixed, frigid Entic Haplorthods
Saprists	Euic Borasaprists
Seelyeville	Euic Typic Borosaprists
Shawano	Mixed, frigid Typic Udipsamments
Shiocton	Coarse-silty, mixed Aquic Haploborolls
*Solona	Coarse-loamy, mixed Aquic Eutroboralfs
Summerville	Loamy, mixed, frigid Lithic Eutrochrepts
Tilleda	Fine-loamy, mixed Typic Glossoboralfs
Wainola	Sandy, mixed, frigid Entic Haplaquods
Waupaca	Coarse-silty, mixed, nonacid, frigid Mollic Fluvaquents
Winterfield	Mixed, frigid Aquic Udipsamments
Worcester	Coarse-loamy, mixed, frigid Aqualfic Haplorthods

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