United States
Department of
Agriculture

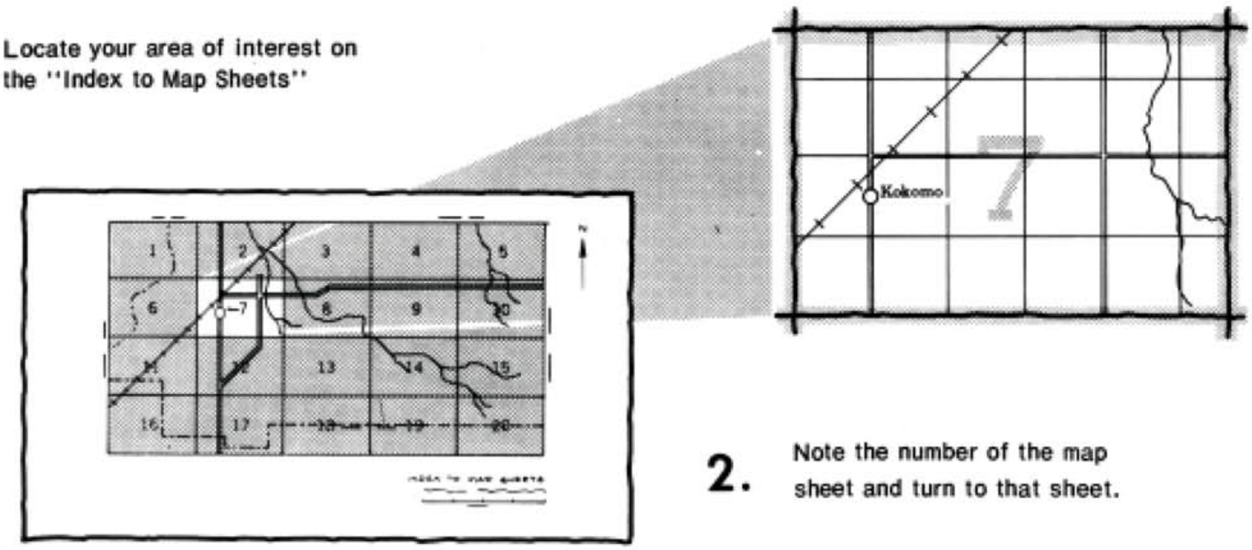
Soil
Conservation
Service

In Cooperation with the
Research Division of the
College of Agricultural
and Life Sciences
University of Wisconsin

Soil Survey of Shawano County, Wisconsin

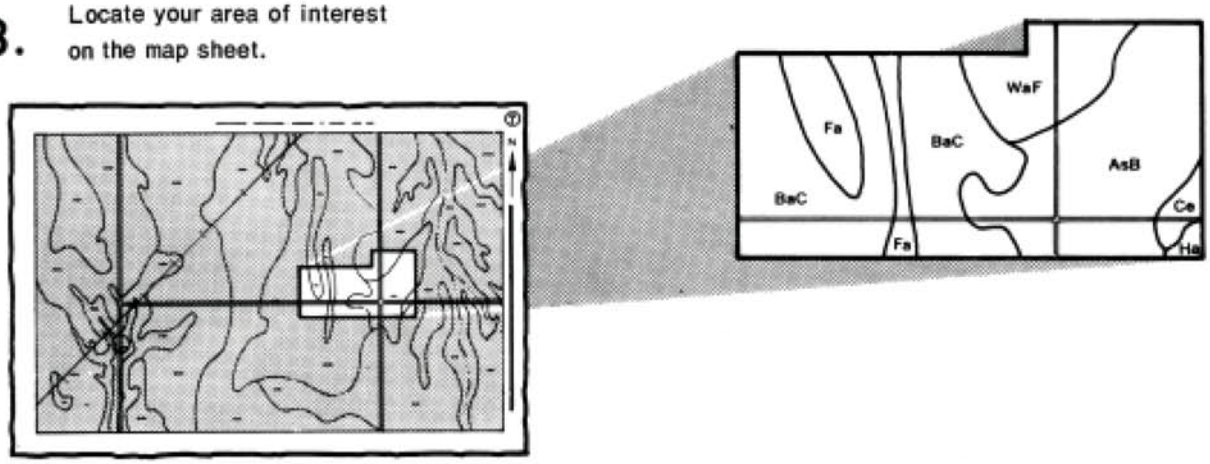
HOW TO USE

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

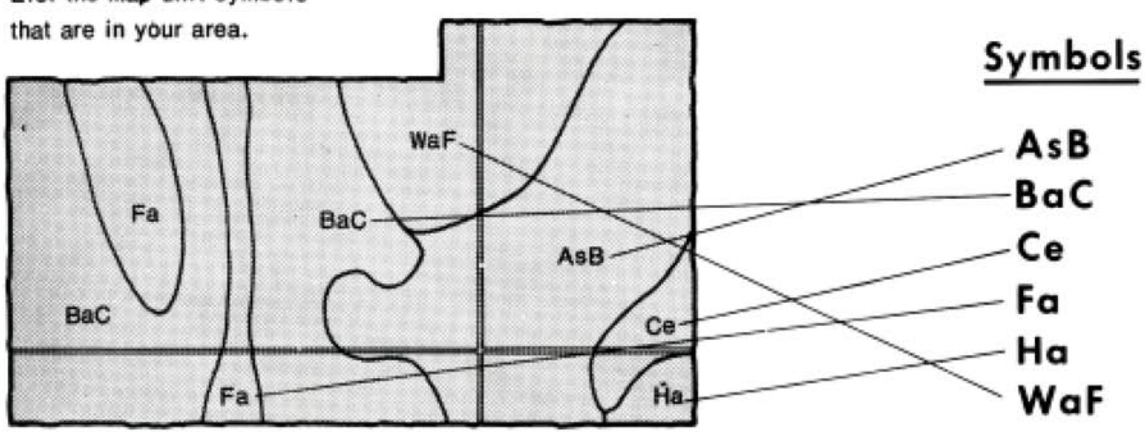


2. Note the number of the map sheet and turn to that sheet.

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

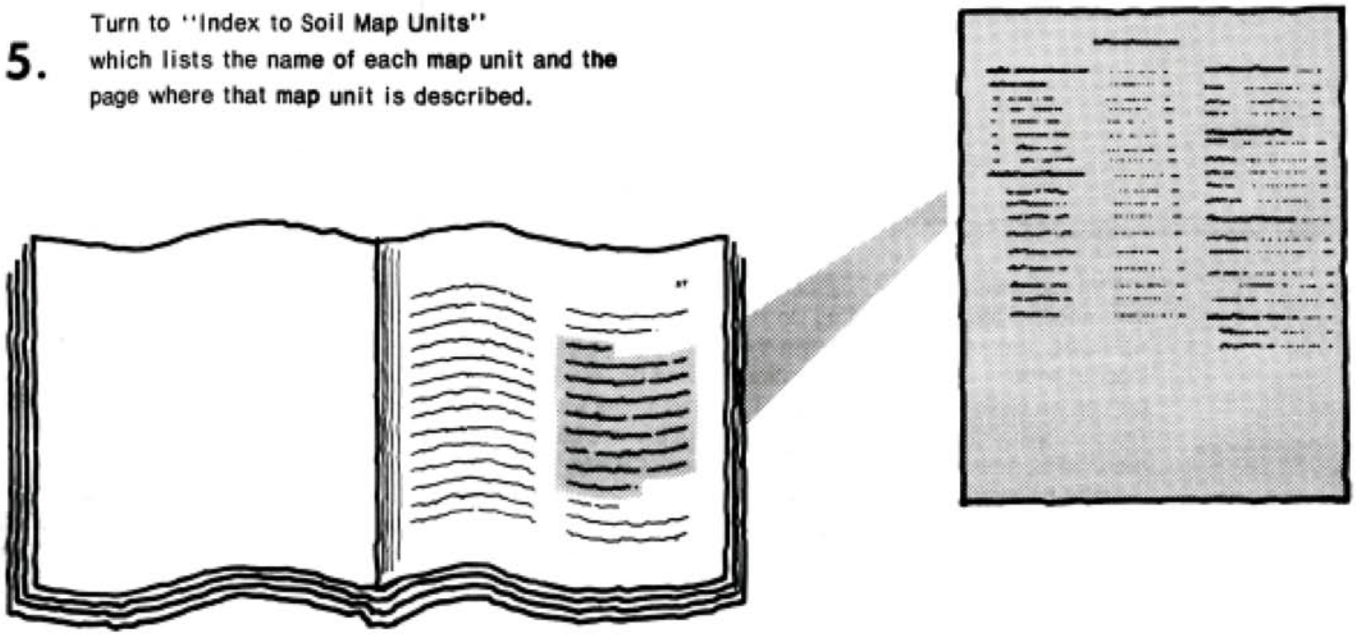


4. List the map unit symbols that are in your area.

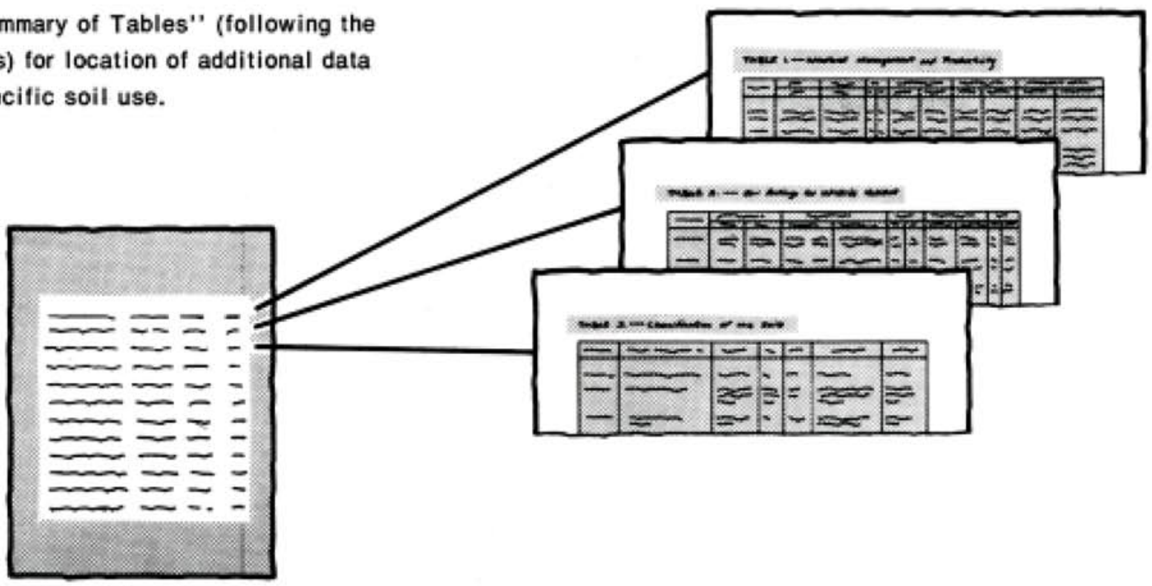


THIS SOIL SURVEY

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



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



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

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

This survey was made cooperatively by the Soil Conservation 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 Shawano County Soil and Water Conservation District, which helped finance the fieldwork. Major fieldwork for this soil survey was performed in the period 1974-1980. Soil names and descriptions were approved in 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981.

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

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soil series

Issued October 1982

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foreword

This soil survey contains information that can be used in land-planning programs in Shawano 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 insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

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

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

Cliffton A. Maguire
State Conservationist
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soil survey of
Shawano County, Wisconsin

By Howard F. Gundlach, John E. Campbell, Terry J. Huffman,
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Fieldwork by John E. Campbell, Howard F. Gundlach, Terry J. Huffman,
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United States Department of Agriculture, Soil Conservation Service,
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Research Division of the College of Agricultural and Life Sciences,
University of Wisconsin

Shawano County is in the northeastern part of Wisconsin (fig. 1) and lies almost entirely within the drainage basin of the Wolf River. It has a total area of 597,055 acres. Of this total, about 586,800 acres is land and 10,255 acres is water. The city of Shawano is the largest community in the county and is the county seat. It has a population of 6,796. There is some diversified manufacturing activity in the county. Lumbering and wood-using industries are major enterprises. Dairy farming is the major agricultural enterprise. Recreation and tourism are important industries, especially in the Shawano Lake area.

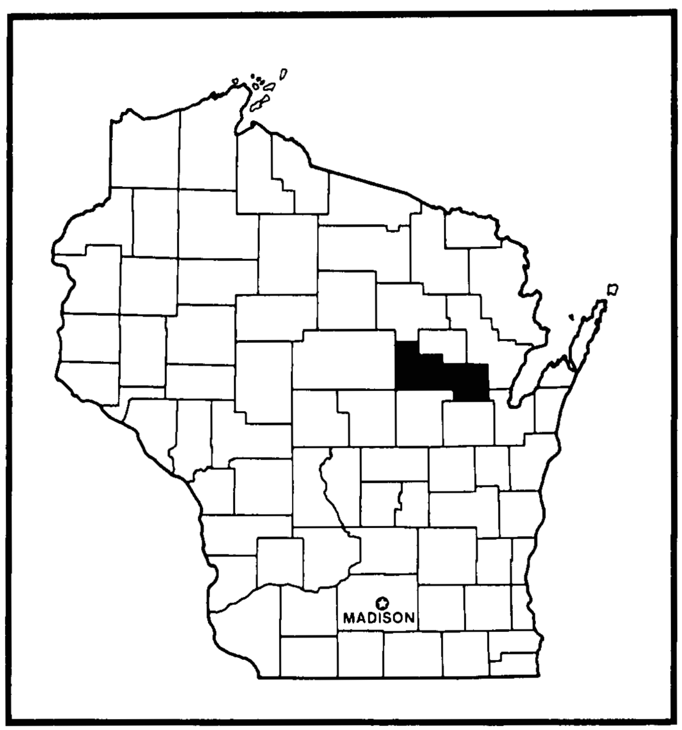

Figure 1.—Location of Shawano County in Wisconsin.

general nature of the county

This section describes the history and development; climate; physiography, relief, and drainage; water supply; and transportation and industry of the county.

history and development

The area that is now Shawano County was inhabited by the Menominee Indians until 1850 when they were moved north to their present reservation. The name "Shawano" was derived from the Menominee word "Shaw-an-aw," which means south and was originally applied to Shawano Lake.

A Frenchman, Jean Nicolet, visited Green Bay and lands to the west in 1634. Father Claude Allouez established a religious mission at the junction of the Wolf River and Shawano Lake Outlet in 1672. The first permanent settlement, however, was not until 1843, when Charles Wescott set up a sawmill on the banks of the Wolf River at the present site of Shawano. Shawano County was created by the state legislature in 1853 from territory that had been part of Oconto and Winnebago Counties.

Agriculture was developed to a limited degree by the Menominee Indians, but a more permanent agriculture grew in conjunction with the lumbering industry. A few sheep and hogs, as well as potatoes and other vegetables, were raised and sold to the lumbering camps. By the l880's dairy farming had become widespread. Farming still prevails as the dominant land use and is likely to remain so for many years.

The 1970 census showed the population of Shawano County to be 32,650 persons, an increase of about 2 percent over the 1960 census.

climate

The climate of Shawano County is continental, characterized by marked changes in weather common to the interiors of large land masses. There is a tendency for extremes in all of the climatic elements. Seasons vary widely from year to year with considerable variation in temperature and precipitation. The area is under the influence of the frequent weather systems that move across the country from west to east. Spring is often late and is a mixture of warm and cold periods. With advancing spring, periods of precipitation are less frequent but more intense. Summers are fully developed and warm with several hot and humid periods that last a few days each. Cool periods generally occur during every month of summer. Dew is often heavy and forms on most mornings. Fall arrives suddenly in mid-September and often lingers on into November. Nearly every year has periods after the killing freeze in which the days are abnormally sunny and warm with clear, hazy skies, and the nights are cool. The change from fall to winter is often abrupt. Snow cover usually lasts from late November until the end of March.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Shawano in the period 1930 to 1959. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring.

In December, January, and February the average temperature is 19.3 degrees F, and the average daily minimum temperature is 9.8 degrees. The lowest temperature on record, which occurred at Shawano in January 1944, is minus 35 degrees. In June, July, and August the average temperature is 69.2 degrees, and the average daily maximum temperature is 82.1 degrees. The highest recorded temperature, which occurred at Shawano in July 1936, is 109 degrees.

The average date of the last 32-degree freeze in spring is May 18, and the first in fall is September 26. The growing season, defined as the number of days between these two dates, averages 131 days. There is a slight variation within the county, depending upon nearness to water and whether the location is in a valley or on a hilltop.

The total annual precipitation is 30.1 inches, which is usually adequate for most agricultural purposes. Of this, 16.6 inches, or 55 percent, usually falls in May through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in May through September is less than 14.8 inches. Some degree of soil moisture deficiency usually occurs in July and August, but severe drought affecting all crops is rare. Most summer precipitation falls as showers of variable length and intensity. The heaviest 1-day rainfall during the period of record was 7.39 inches at Shawano on July 23, 1912. Thunderstorms occur on about 32 days each year, and most occur in June and July. Hail falls on an average of 2 days a year.

Average seasonal snowfall is 46.9 inches. The greatest snow depth at any one time during the period of record was 79 inches.

The average relative humidity in midafternoon is about 65 percent. Humidity is higher at night, and the average at dawn is about 82 percent. The sun shines 60 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the west. Average windspeed is highest, 12 miles per hour, in April and November. It is lowest, 8 miles per hour, in July and August. The highest wind speeds are usually from the west.

physiography, relief, and drainage

Within Shawano County there are three major areas with distinct physiographic characteristics.

Major portions of Wescott, Waukechon, Navarino, and Belle Plaine Townships are in a broad, level glacial lake basin. Shawano Lake occupies part of this basin, and the Wolf River flows through it. In the sandier parts of the basin there is dunelike topography, especially in areas to the north of Shawano Lake, in western Navarino Township, and in southeastern Belle Plaine Township.

East of the lake basin is an undulating and gently rolling ground moraine with numerous basins and depressions. This area generally slopes to the east, except for a small area that slopes westerly toward the Wolf River. The highest elevation is about 1,030 feet, east of Bonduel, and the lowest is 760 feet, where the Oconto River leaves the county.

West of the lake basin the ground moraine continues, but it is interspersed with undulating outwash plains. Much of the outwash is pitted, and this gives the landscape a hilly appearance with many enclosed basins and depressions. The land west of the Wolf River generally slopes to the southeast. The elevation changes from about 1,413 feet near Aniwa to about 780 feet where the Wolf River flows out of the county.

About 87.7 percent of Shawano County lies within the Wolf River watershed. The eastern 12 percent of the county is drained by streams that empty directly into Green Bay. The extreme northwestern corner, about 0.3 percent of the county, drains west to the Plover River in the Wisconsin River watershed.

In general, the overall natural surface water drainage system is not well developed. The numerous basins and depressions tend to accumulate and hold runoff so that the release of surface water to flowing streams is greatly restricted.

water supply

The many streams, lakes, and rivers in Shawano County furnish an abundant supply of surface water. For most uses, however, ground water is the major source. In most areas of Shawano County, enough ground water is readily available to meet present and anticipated future needs for domestic, agricultural, municipal, and industrial uses. In the western half of the county, there may be inadequate supplies of ground water in some areas where glacial deposits are thin over the crystalline bedrock.

Ground water is at various depths below the surface depending upon the general topography, the elevation above the permanent stream level, and the character of the underlying rock formation. It is stored in porous strata called aquifers. At certain depths below the surface all pores and fissures in the bedrock or in unconsolidated material such as sand and gravel are filled with water. It is into these water-filled layers that wells must be drilled in order to obtain an adequate supply of water. The level of ground water will rise and fall from season to season and year to year depending on rainfall.

Glacial drift aquifers are the major source of ground water in the western three-fourths of the county. The glacial drift over most of this area is 50 to 200 feet thick and produces well yields of 100 to 1,000 gallons per minute (*5*).

The bedrock aquifer is the major source of ground water in the eastern quarter of the county. The Cambrian sandstones, the Prairie du Chien Group, and the St. Peter sandstone form the principal bedrock aquifer in this area. In general, these rock units are hydraulically connected and act as one aquifer to produce well yields of 100 to 500 gallons per minute.

Ground water in Shawano County is generally of good quality whether it is from the bedrock aquifer or from the glacial drift aquifer. 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 are the result of variations in the composition, solubility, and surface area of the individual particles of the soil and rock through which the water moves and the length of time the water is in contact with these materials. The main chemical constituents in the water are calcium, magnesium, and bicarbonate ions derived from dolomite and glacial drift containing fragments of dolomite. Minor problems are caused by hardness and, in some areas, by high concentrations of iron.

transportation and industry

Rail service in Shawano County is provided by two lines that interconnect in the city of Shawano. All parts of the county can be reached by good hard-surfaced or gravel roads. State Highway 45 is the main north-south road in the western part of the county. State Highways 22, 47, and 55 are the main north-south roads in the eastern part of the county. State Highway 29 is the main east-west road in the county. The latter four of these highways intersect in the city of Shawano. Major commercial air transportation is provided at airports in the vicinity of Green Bay, Appleton, and Wausau. Small aircraft can use Wilmer Zueske Field at Shawano.

Agriculture is the major industry in Shawano County, but forestry and recreation are also important. Dairy farming is the major agricultural enterprise, but beef cattle are fairly well represented. Hogs and other livestock are raised in relatively small numbers. In addition, a number of major agricultural industries are headquartered in the county. The number of farms in the county is decreasing, and the average size of farms is increasing. The average value of the land and the average number of buildings per farm are also increasing.

About 46 percent of Shawano County is in woodland and, because of this, lumber and related wood products industries are important. In 1975 six of the eight largest manufacturing employers in the county were involved in industries that rely primarily on local wood sources. The making of maple syrup is a seasonal woodland industry of local importance (fig. 2).

Mineral production in the county is of minor extent and presently includes sand and gravel and crushed or ground dolomite (fig. 3).

The tourist and recreation industry has long been an important part of the economy in Shawano County. The numerous streams and lakes (especially Shawano Lake) provide ample facilities for swimming, fishing, and boating and attract many vacationers and sportsmen. Wildlife, especially deer, attract hunters during hunting season. Winter usually provides ample amounts of snow for snowmobile and cross-country skiing enthusiasts.

Figure 2.—Sugar maple trees on Kennan soils are tapped in the spring for sap.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

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

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

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

Figure 3.—Quarry of dolomite bedrock under Fairport soils. Dolomite is blasted and then crushed for gravel or ground for lime.

general soil map units

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

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

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

soil descriptions

1. Kennan-Rosholt

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

Areas of these soils are on ridgetops, side slopes, and valley floors on outwash plains, stream terraces, moraines, and drumlins (fig. 4).

This map unit covers about 14 percent of the county. It is about 53 percent Kennan soils, 12 percent Rosholt soils, and 35 percent soils of minor extent.

Kennan soils are well drained. They are moderately permeable. The available water capacity is moderate. Typically, the surface layer is black bouldery fine sandy loam about 2 inches thick. The upper part of the subsoil is dark yellowish brown, friable fine sandy loam about 3 inches thick. The next layer is mostly brown, friable fine sandy loam about 11 inches thick. The lower part of the subsoil extends to a depth greater than 60 inches. It is dark brown and brown, friable sandy loam and very friable loamy sand.

Rosholt soils are well drained. They are moderately rapidly permeable in the subsoil and very rapidly permeable in the substratum. The available water capacity is low. Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is brown, friable fine sandy loam about 5 inches thick. The subsoil is about 21 inches thick. It is mostly dark brown, friable fine sandy loam and sandy loam in the upper part and brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand and gravel in the upper part and yellowish brown, loose coarse and medium sand in the lower part.

Some of the minor soils in this unit are the Cathro, Cromwell, Markey, Minocqua, Oesterle, Scott Lake, and Seelyeville soils. The excessively drained Cromwell soils are on flats and side slopes. The somewhat poorly drained Oesterle soils are on low-lying flats and in drainageways and depressions. The very poorly drained Cathro, Markey, and Seelyeville soils formed in organic material and are in drainageways, in depressions, and on low-lying flats. The poorly drained and very poorly drained Minocqua soils are on low-lying flats and in drainageways and depressions. The moderately well drained Scott Lake soils are on flats, side slopes, and foot slopes.

Many of the less sloping areas of these soils are used for growing cultivated crops. Many areas, especially of the steeper soils, are in woodland or pasture. Erosion, droughtiness, and soil blowing are the main hazards to the use of these soils for growing cultivated crops. Boulders on the surface are also a limitation on many areas of Kennan soils.

The nearly level, gently sloping, and sloping areas of these soils are suited to cultivated crops. In addition the moderately steep areas of Kennan soils are suitable for this use. These soils are suited to growing trees. The less sloping areas of these soils are suited to residential development, but boulders are a problem on Kennan soils. Septic tank absorption fields will function satisfactorily, but in the Rosholt soils there is a danger of ground water pollution because of the very rapid permeability in the substratum. Moderately steep and steep areas of these soils are poorly suited to residential development because of the slope.

2. Rosholt-Seelyeville

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

Areas of these soils are on flats, on side slopes, in depressions, and in drainageways on outwash plains and stream terraces.

This map unit covers about 28 percent of the county. It is about 32 percent Rosholt soils, 11 percent Seelyeville soils, and 57 percent soils of minor extent.

Rosholt soils are well drained. They are moderately rapidly permeable in the subsoil and very rapidly permeable in the substratum. They have low available water capacity. Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is brown, friable fine sandy loam about 5 inches thick. The subsoil is about 21 inches thick. It is mostly dark brown, friable fine sandy loam and sandy loam in the upper part and brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand and gravel in the upper part and yellowish brown, loose coarse and medium sand in the lower part.

Seelyeville soils are very poorly drained. They have moderately rapid permeability and very high available water capacity. Typically, the organic layer is more than 60 inches thick and is very dark brown muck in the upper part and is black, very dark grayish brown, and dark brown muck in the lower part.

Some of the minor soils in this unit are the Antigo, Brill, Cathro, Cromwell, Elderon, Kennan, Markey, Menahga, Minocqua, Oesterle, and Scott Lake soils. Antigo soils formed mostly in silty deposits over outwash sand and gravel and are on flats and side slopes. The moderately well drained Brill and Scott Lake soils are on flats, side slopes, and foot slopes. Markey and Cathro soils formed in 16 to 51 inches of organic material over mineral material and are in drainageways, in depressions, and on low-lying flats. The excessively drained Cromwell soils are on flats and side slopes. The somewhat excessively drained Elderon soils are very cobbly in the subsoil and substratum and are on side slopes. Kennan soils formed in sandy loam and loamy sand glacial till and are on ridgetops and side slopes. The somewhat poorly drained Oesterle soils are on low-lying flats and in drainageways and depressions. The excessively drained Menahga soils are sandy throughout and are on flats and side slopes. The poorly drained and very poorly drained Minocqua soils formed in loamy deposits over outwash and are on low-lying flats and in drainageways and depressions.

Some of the less sloping areas of Rosholt soils are used for cultivated crops. Most areas of the Seelyeville soils and some areas of the Rosholt soils, especially the steeper areas, are in woodland. Erosion, soil blowing, droughtiness, and wetness are the main limitations to the use of these soils for cultivated crops. Stoniness is also a limitation on many areas of the Rosholt soils.

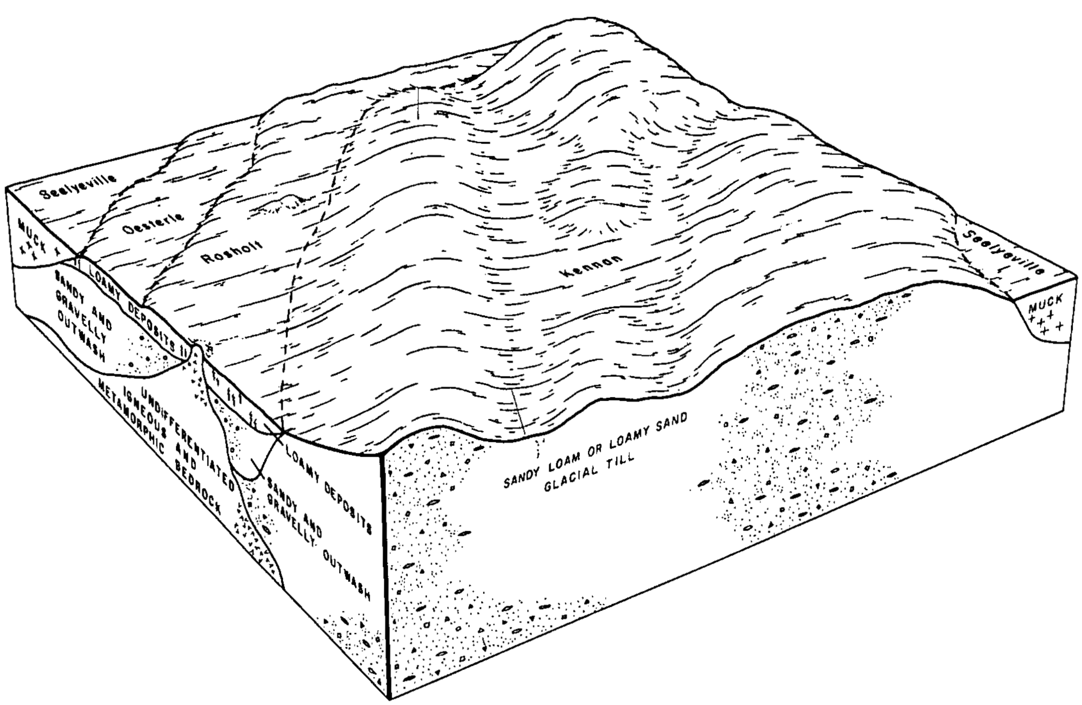

Figure 4.—Relationship of soils and substratum in the Kennan-Rosholt general map unit.

Where irrigated and protected from soil blowing, areas of Rosholt soils that are nearly level, gently sloping, and sloping are suited to growing cultivated crops. Where drained, areas of Seelyeville soils are suited to growing cultivated crops. The length of the growing season, however, is limited by frosts late in spring and early in fall. All of these soils are suited to growing trees. Harvesting of trees is a problem, however, on the very poorly drained Seelyeville soils. The less sloping areas of Rosholt soils are suited to residential development. Septic tank absorption fields will function satisfactorily, but there is a danger of ground water pollution because of the very rapid permeability in the substratum. Seelyeville soils are unsuitable for residential development or septic tank absorption fields.

3. Tilleda-Menominee

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

Areas of these soils are on flats and convex side slopes of moraines.

This map unit covers about 13 percent of the county. It is about 45 percent Tilleda soils, 12 percent Menominee soils, and 43 percent soils of minor extent.

Tilleda soils are well drained. They have moderate permeability and high available water capacity. Typically, the surface layer is very dark grayish brown fine sandy loam about 7 inches thick. The upper part of the subsoil is dark brown, friable fine sandy loam about 2 inches thick. The next layer is mostly brown, friable fine sandy loam about 3 inches thick. The lower part of the subsoil is about 22 inches thick. It is mostly dark reddish brown, friable and firm loam. The substratum, to a depth of about 60 inches, is dark reddish brown, friable loam.

Menominee soils are well drained. They have rapid permeability in the sandy upper part and moderate permeability in the loamy lower part. They have moderate available water capacity. Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The upper part of the subsoil is about 18 inches thick. It is dark brown and brown, very friable loamy sand and sand. The next layer is brown, very friable fine sandy loam about 4 inches thick. The lower part of the subsoil is about 16 inches thick. It is mostly reddish brown, friable clay loam. The substratum, to a depth of about 60 inches, is reddish brown, friable loam.

Some of the minor soils in this unit are the Iosco, Kennan, Menahga, Rosholt, Solona, and Tilleda Variant soils. The somewhat poorly drained Iosco and Solona soils are on low-lying flats, in depressions and drainageways, and on foot slopes. Kennan soils formed in sandy loam and loamy sand glacial till and are on ridgetops and side slopes. The excessively drained Menahga soils are sandy throughout and are on flats and side slopes. Rosholt and Tilleda Variant soils are underlain by sand or sand and gravel at a depth of 20 to 40 inches and are on flats and side slopes.

Many of the less sloping areas of these soils are used for cultivated crops. Some areas, especially of the steeper soils, are in woodland or pastureland. Erosion and soil blowing are the main hazards to the use of Tilleda and Menominee soils for cultivated crops. Droughtiness is also a hazard to the use of Menominee soils for cultivated crops.

Most areas of these soils are suited to growing cultivated crops. Moderately steep areas of Menominee soils, however, are poorly suited to crops. The soils in this unit are suited to growing trees. The less sloping areas of these soils are suited to residential development. There are, however, moderate limitations for septic tank absorption fields because of the moderate permeability in the Tilleda soils and severe limitations because of the rapid permeability in the upper layers of the Menominee soils. Septic tank absorption fields will function satisfactorily in Menominee soils, but there is a danger of lateral movement of the effluent if the absorption field is placed in the sandy upper layers. Moderately steep areas of these soils are poorly suited to residential development because of the slope.

4. Menahga-Croswell-Mahtomedi

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

Areas of these soils are on flats and convex side slopes and in drainageways and depressions on outwash plains (fig. 5).

This map unit covers about 9 percent of the county. It is about 29 percent Menahga soils, 10 percent Croswell soils, 8 percent Mahtomedi soils, and 53 percent soils of minor extent.

Menahga soils are excessively drained. They have rapid permeability and low available water capacity. Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsoil is about 26 inches thick. It is brown and strong brown sand in the upper part and strong brown, loose coarse sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand.

Croswell soils are moderately well drained. They have rapid permeability and low available water capacity. Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is brown loamy sand about 3 inches thick. The subsoil is about 24 inches thick. It is dark reddish brown, very friable loamy sand in the upper part; dark brown, loose sand in the middle; and strong brown, mottled, loose sand in the lower part. The substratum, to a depth of about 60 inches, is yellowish brown, mottled, loose sand.

Mahtomedi soils are excessively drained. They have rapid permeability and low available water capacity.

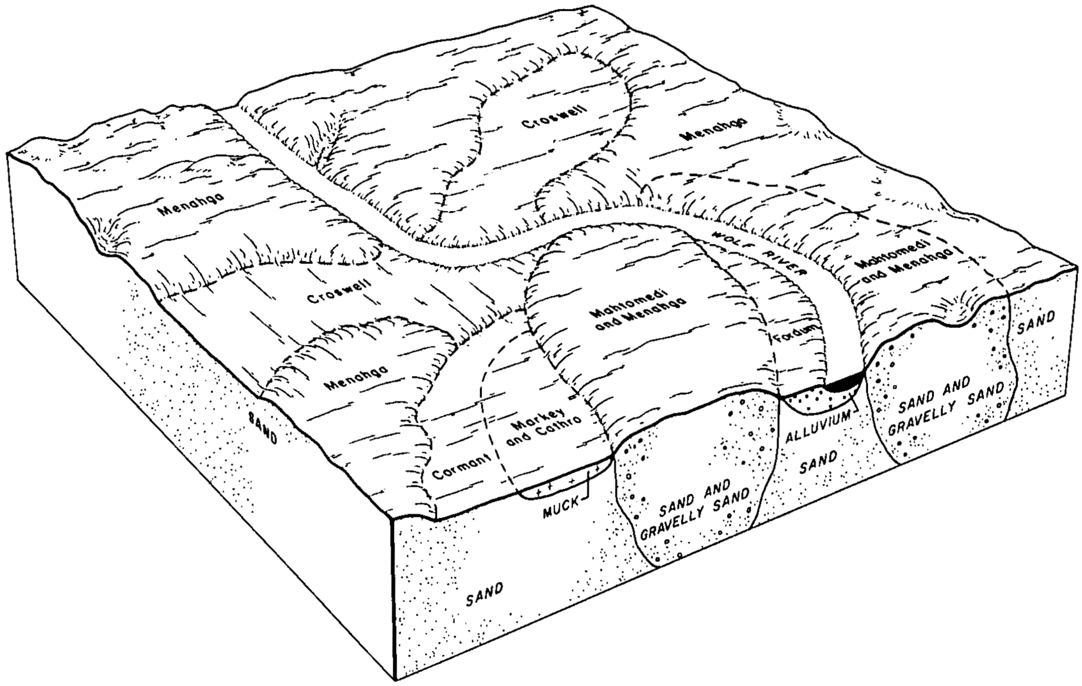

Figure 5.—Relationship of soils and substratum in the Menahga-Croswell-Mahtomedi general map unit.

Typically, the surface layer is dark brown loamy sand about 6 inches thick. The subsoil is about 27 inches thick. It is brown, very friable loamy sand in the upper part and reddish brown, very friable gravelly loamy sand and gravelly sand in the lower part. The substratum, to a depth of about 60 inches, is brown and light brown, loose gravelly sand.

Some of the minor soils in this unit are the Au Gres, Cormant, Fordum, Markey, Rosholt, Rousseau, Rubicon, Shawano, and Tilleda soils. The somewhat poorly drained Au Gres soils are on low-lying flats, in drainageways and depressions, and on concave foot slopes. The poorly drained and very poorly drained Cormant and Fordum soils are on low-lying flats and flood plains and in depressions and drainageways. The very poorly drained Markey soils formed in organic material and are on low-lying flats and in depressions and drainageways. The well drained Rosholt soils formed in 20 to 40 inches of loamy material over outwash and are on flats and side slopes. Rousseau and Shawano soils formed in sands that are more than 50 percent fine sand. Rubicon soils have a subsoil horizon where organic matter and aluminum have accumulated, either with or without iron, and are on side slopes. The well drained Tilleda soils formed in glacial till and are on flats and side slopes.

Many of the less sloping areas of these soils are used for cultivated crops and pasture. Many areas are in native woodland, and some areas have been planted to pine trees. Droughtiness and soil blowing are the main limitations or hazards to the use of these soils for cultivated crops.

Where irrigated and protected from soil blowing, nearly level to sloping areas of these soils are suited to cultivated crops. Moderately steep and steep areas of Menahga and Mahtomedi soils are poorly suited to this use. The soils in this unit are suited to trees. Nearly level to sloping areas of Menahga and Mahtomedi soils are suited to residential development. Septic tank absorption fields will function satisfactorily, but there is a danger of ground water pollution because of the rapid permeability. Moderately steep and steep areas of Menahga and Mahtomedi soils are poorly suited to residential development because of the slope. Croswell soils are poorly suited to residential development because of the seasonal high water table.

5. Cormant-Markey-Wainola

Nearly level and gently sloping, somewhat poorly drained to very poorly drained, sandy and mucky soils; on uplands and in upland drainageways and depressions

Areas of these soils are on low-lying flats, in drainageways and depressions, and on concave foot slopes on outwash plains and basins of glacial lakes.

This map unit covers about 5 percent of the county. It is 20 percent Cormant soils, 20 percent Markey soils, 14 percent Wainola soils, and 46 percent soils of minor extent.

Cormant soils are poorly drained and very poorly drained with rapid permeability and low available water capacity. Typically, the surface layer is black mucky loamy fine sand about 8 inches thick. The substratum, to a depth of about 60 inches, is dark grayish brown, mottled, loose loamy fine sand in the upper part and light brownish gray, dark grayish brown, and dark gray, mottled, loose fine sand in the lower part.

Markey soils are very poorly drained. They have moderately rapid permeability in the organic layer and rapid permeability in the sand substratum. The available water capacity is high. Typically, the organic layer is black muck about 28 inches thick. The substratum, to a depth of about 60 inches, is dark grayish brown, loose sand.

Wainola soils are somewhat poorly drained. They have rapid permeability and low available water capacity. Typically, the surface layer is black fine sand about 2 inches thick. The subsurface layer is brown, very friable fine sand about 3 inches thick. The subsoil is about 17 inches thick. It is dark brown, mottled, very friable fine sand in the upper part and strong brown, mottled, very friable fine sand in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, loose stratified fine sand and very fine sand.

Some of the minor soils in this unit are the Au Gres, Au Gres Variant, Brevort, Fordum, Rousseau, Seelyeville, Shawano, and Wheatley soils. The somewhat poorly drained Au Gres soils formed in sands that are less than 50 percent fine sands and are on low-lying flats, in drainageways and depressions, and on concave foot slopes. Somewhat poorly drained Au Gres Variant soils and poorly drained and very poorly drained Wheatley soils are underlain by calcareous sand and gravel and are on low-lying flats, in drainageways and depressions, and on concave foot slopes. Brevort soils are underlain by loamy deposits at a depth of 20 to 40 inches and are on low-lying flats and in drainageways and depressions. Fordum soils consist of stratified loamy and silty alluvial deposits and are on nearly level flood plains and in drainageways. The moderately well drained Rousseau soils and excessively drained Shawano soils are on flats and side slopes. The very poorly drained Seelyeville soils formed in organic material more than 51 inches thick and are on low-lying flats and in drainageways and depressions.

Most areas of these soils are undrained and are used for pasture and woodland. Some areas are drained and used for cropland. Flooding, ponding, and soil blowing are the main hazards. Wetness is the main limitation.

Where these soils are adequately drained and protected from flooding, ponding, and soil blowing they are suited to growing cultivated crops. The length of the growing season is limited on Markey soils, however, by frosts late in spring and early in fall. Markey and Wainola soils are suited to growing trees. Cormant soils are poorly suited to trees. The soils in this unit are poorly suited to residential development because of the seasonal high water table and flooding.

6. Shawano-Rousseau-Wainola

Nearly level to moderately steep, excessively drained and moderately well drained and somewhat poorly drained, sandy soils; on uplands

Areas of these soils are on convex side slopes, on low-lying flats, and in drainageways and depressions on outwash plains and basins of glacial lakes (fig. 6).

This map unit covers about 3 percent of the county. It is about 27 percent Shawano soils, 20 percent Rousseau soils, 10 percent Wainola soils, and 43 percent soils of minor extent.

Shawano soils are excessively drained. They have rapid permeability and low available water capacity. Typically, the surface layer is dark brown loamy fine sand about 8 inches thick. The subsoil is about 26 inches thick. It is strong brown, very friable and loose fine sand. The substratum, to a depth of about 60 inches, is reddish yellow, loose fine sand.

Rousseau soils are moderately well drained. They have rapid permeability and low available water capacity. Typically, the surface layer is dark brown loamy fine sand about 12 inches thick. The subsoil is about 21 inches thick. It is strong brown, very friable fine sand in the upper part and brown, mottled, very friable fine sand in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, loose fine sand.

Wainola soils are somewhat poorly drained. They have rapid permeability and low available water capacity. Typically, the surface layer is black fine sand about 2 inches thick. The subsurface layer is brown, very friable fine sand about 3 inches thick. The subsoil is about 17 inches thick. It is dark brown, mottled, very friable fine sand in the upper part and strong brown, mottled, very friable fine sand in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, loose, stratified fine sand and very fine sand.

Some of the minor soils in this unit are the Au Gres, Cormant, Croswell, Markey, Menahga, Salter Variant, and Shiocton soils. The somewhat poorly drained Au Gres soils, the moderately well drained Croswell soils, and the excessively drained Menahga soils formed in sands that are less than 50 percent fine sands. Au Gres and Croswell soils are on low-lying flats, in drainageways and depressions, and on concave foot slopes. Menahga soils are on flats and side slopes. Poorly drained and very poorly drained Cormant soils are on low-lying flats

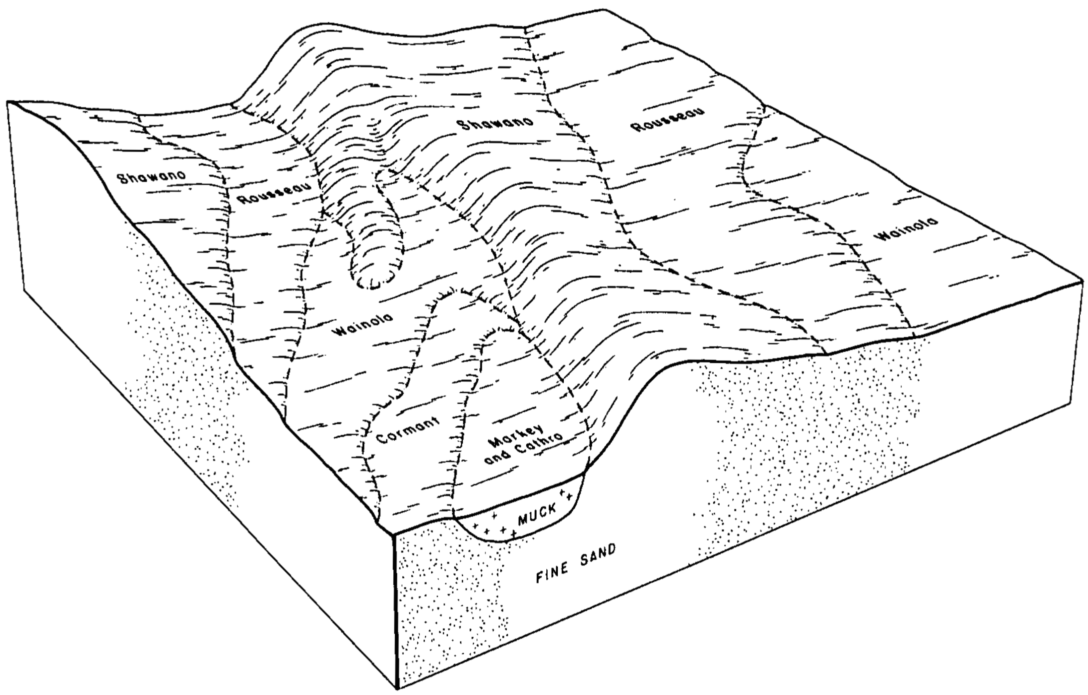

Figure 6.—Relationship of soils and substratum in the Shawano-Rousseau-Wainola general map unit.

and in depressions and drainageways. The very poorly drained Markey soils formed in 16 to 51 inches of organic material and are on low-lying flats in depressions and drainageways. The well drained and moderately well drained Salter Variant soils and the somewhat poorly drained Shiocton soils are formed in calcareous, stratified loamy and silty lacustrine deposits.

Many areas of Rousseau and Shawano soils and drained areas of Wainola soils are used for cultivated crops. Some areas are used for pasture or woodland, especially the steeper Shawano soils and the undrained Wainola soils. Droughtiness and soil blowing are the main limitations or hazards to the use of these soils for cultivated crops. Wetness is a limitation for this use on the Wainola soils.

Where adequately drained, irrigated, and protected from soil blowing, nearly level to sloping areas of these soils are suited to growing cultivated crops. Moderately steep Shawano soils and undrained Wainola soils are poorly suited to this use. The soils in this unit are suited to growing trees. Nearly level to sloping areas of Shawano soils are suited to residential development. Septic tank absorption fields will function satisfactorily, but there is a danger of ground water pollution because of the rapid permeability. Moderately steep areas of Shawano soils are poorly suited to residential development because of the slope. Rousseau and Wainola soils are poorly suited to this use because of the seasonal high water table.

7. Shiocton-Bach-Iosco

Nearly level and gently sloping, somewhat poorly drained to very poorly drained, silty and sandy soils; on bottom lands, on flats, and in upland depressions

Areas of these soils are on low-lying flats, in drainageways and depressions, and on concave foot slopes on basins of glacial lakes.

This unit covers about 4 percent of the county. It is about 27 percent Shiocton soils, 9 percent Bach soils, 9 percent Iosco soils, and 55 percent soils of minor extent.

Shiocton soils are somewhat poorly drained. They have moderate permeability and high available water capacity. Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsoil is about 16 inches thick. It is brown, mottled, friable silt loam in the upper part and brown, mottled, very friable very fine sandy loam in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, very friable very fine sandy loam in the upper part and multicolored, very friable, stratified silt loam and very fine sand in the lower part.

Bach soils are poorly drained and very poorly drained. They have moderate permeability and high available water capacity. Typically, the surface layer is black silt loam about 8 inches thick. The subsoil is about 16 inches thick. It is gray, mottled, friable silt loam in the upper part, light brownish gray, mottled, friable loamy very fine sand in the middle; and light brownish gray, mottled, friable stratified very fine sandy loam, silt loam, and very fine sand in the lower part. The substratum, to a depth of about 60 inches, is light brownish gray and gray, mottled, friable, stratified loamy very fine sand, very fine sandy loam, silt loam, and very fine sand.

Iosco soils are somewhat poorly drained. They are rapidly permeable in the sandy mantle and moderately slowly permeable in the lower subsoil and substratum. They have moderate available water capacity. Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsoil is about 38 inches thick. The upper part is brown, mottled, very friable loamy sand about 16 inches thick; the lower part is mostly reddish brown, mottled, friable loam. The substratum, to a depth of about 60 inches, is reddish brown, friable loam.

Some of the minor soils in this unit are the Brevort, Cathro, Cormant, Rousseau, Salter Variant, Seelyeville, Shawano, and Wainola soils. The poorly drained and very poorly drained Brevort soils formed in 20 to 40 inches of sandy deposits underlain by loamy deposits and are on low-lying flats and in drainageways and depressions. The very poorly drained Cathro and Seelyeville soils formed in organic material and are on low-lying flats and in depressions and drainageways. The poorly drained and very poorly drained Cormant soils are sandy throughout and are on low-lying flats and in depressions and drainageways. The moderately well drained Rousseau soils are sandy throughout and are on side slopes, foot slopes, and low-lying flats and in depressions and drainageways. The moderately well drained and well drained Salter Variant soils are on flats and side slopes. The excessively drained Shawano soils are sandy throughout and are on flats and side slopes. The somewhat poorly drained Wainola soils are sandy throughout and are on low-lying flats, in drainageways and depressions, and on concave foot slopes.

Many areas of these soils are used for cultivated crops. Some areas are used for pasture or woodland, especially undrained areas. Flooding, wetness, and soil blowing are the main limitation and hazards to the use of these soils for cultivated crops.

Where adequately drained, these soils are suited to growing cultivated crops. Iosco soils also need protection from soil blowing. The soils in this unit are suited to growing trees. They are poorly suited to residential development because of flooding and the seasonal high water table.

8. Onaway-Solona

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

Areas of these soils are on convex side slopes, on low-lying flats, and in depressions and drainageways on ground moraines (fig. 7).

This map unit covers about 24 percent of the county. It is about 38 percent Onaway soils, 26 percent Solona soils, and 36 percent soils of minor extent.

Onaway soils are well drained and moderately well drained. They have moderate permeability and moderate available water capacity. Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsurface layer is mostly brown, friable fine sandy loam about 6 inches thick. The subsoil is about 13 inches thick. It is dark reddish brown, firm clay loam in the upper part and dark reddish brown, friable loam in the lower part. The substratum, to a depth of about 60 inches, is dark brown, friable sandy loam.

Solona soils are somewhat poorly drained. They have moderate permeability and high available water capacity. Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 18 inches thick. It is reddish brown, mottled, friable fine sandy loam. The substratum, to a depth of about 60 inches, is reddish brown, mottled, friable loam.

Some of the minor soils in this unit are the Angelica, Bach, Cathro, Fairport, Iosco, Menominee, Seelyeville, Shiocton, and Tilleda soils. The poorly drained and very poorly drained Angelica soils are on low-lying flats and in depressions. The poorly drained and very poorly drained Bach soils and the somewhat poorly drained Shiocton soils formed in calcareous, stratified lacustrine deposits that are silty, loamy, and sandy and are on low-lying flats, in drainageways and depressions, and on concave foot slopes. The very poorly drained Cathro and Seelyeville soils formed in organic material and are on low-lying flats and in drainageways and depressions. The well drained Fairport soils are underlain by dolomite bedrock at a depth of 20 to 40 inches and are on side slopes. The somewhat poorly drained Iosco soils have a 20- to 40-inch-thick sandy mantle and are on low-lying flats and in drainageways and depressions. The well drained Menominee soils have a 20- to 40-inch-thick sandy mantle and are on flats and side slopes. The well drained Tilleda soils are weathered deeper to free carbonates and are on flats and side slopes.

Most areas of these soils are used for growing cultivated crops. Some areas, however, are used for pastureland or woodland, especially the steeper Onaway soils and the undrained Solona soils. Erosion and wetness are the main hazard and limitation to the use of these soils for growing cultivated crops.

Most areas of the Onaway soils and adequately drained areas of the Solona soils are suited to growing

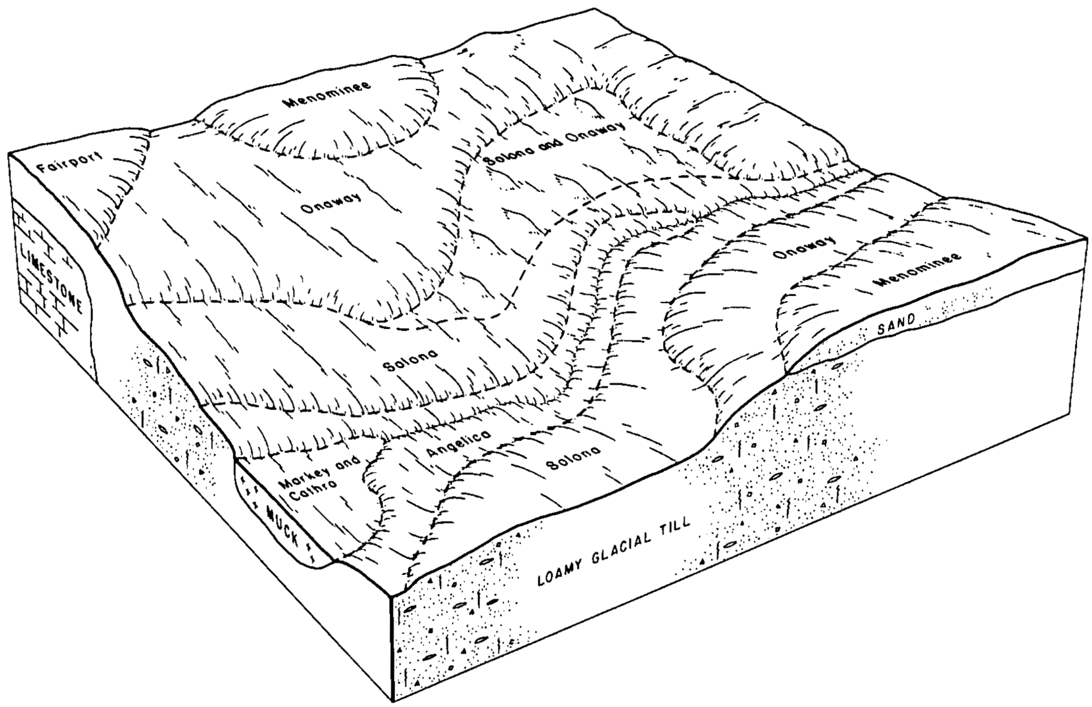

Figure 7.—Relationship of soils and substratum in the Onaway-Solona general map unit.

cultivated crops. Steep and very steep areas of Onaway soils and undrained areas of Solona soils are poorly suited to this use. The soils in this unit are suited to growing trees. Gently sloping, well drained areas of Onaway soils are suited to residential development. Moderately steep, steep, and very steep areas of Onaway soils are poorly suited to residential development because of the slope. Areas of Solona soils are poorly suited to residential development because of the seasonal high water table and flooding.

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 underlying material. 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, Kennan bouldery fine sandy loam, 1 to 6 percent slopes, is one of several phases in the Kennan series.

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

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Elderon-Rosholt complex, 12 to 20 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 a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Markey and Cathro mucks 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.

Table 3 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

AfB—Alban fine sandy loam, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 55 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 7 inches thick. The subsoil is about 31 inches thick. It is mostly reddish brown, very friable fine sandy loam in the upper part; reddish brown, friable loam in the middle part; and reddish brown, friable very fine sandy loam in the lower part. The substratum, to a depth of about 60 inches, is reddish brown, mottled, friable very fine sandy loam. Some small areas are nearly level. In some places the surface layer is loam or silt loam, and in some places the substratum is sand or sand and gravel.

Included with this soil in mapping are small areas of Alban Variant and Plover soils. The Alban Variant soils are similar to the Alban soil in position on the landscape but have a sandy mantle 20 to 40 inches thick. The somewhat poorly drained Plover soils are in slightly lower landscape positions in drainageways and depressions. Other inclusions are small sloping areas and severely eroded areas of Alban fine sandy loam. Also included are some very stony areas. These inclusions make up 5 to 15 percent of the unit.

Permeability is moderate in this Alban soil. The available water capacity is high. Surface runoff from cultivated areas is medium. The water table is within 3 feet of the surface during wet seasons. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled.

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used for pasture or hayland, erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table. This problem can be overcome by building a filtering mound of suitable material or by pumping effluent to an absorption field located on higher, more suitable soils. This soil is suited to dwellings without basements. It is moderately suited to dwellings with basements because of the seasonal high water table. This problem can be overcome by installing a subsurface drainage system with gravity outlet or other dependable outlet, or by raising the site elevation with fill material. This soil is moderately suited to local roads and streets because of the moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel, or by draining the roadbed by subsurface drainage.

This soil is in capability unit IIe-1 and woodland suitability subclass 2o.

AgB—Alban Variant loamy sand, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 45 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is about 16 inches thick. It is reddish brown and brown, very friable and loose sand in the upper part and brown, mottled, friable loam in the lower part. The substratum, to a depth of about 60 inches, is brown and reddish brown, mottled, friable, stratified silt loam, loam, sandy loam, and sand in the upper part and brown, mottled, loose sand with strata of loamy sand in the lower part. Some small areas are eroded and in some places the surface layer is sand. In some places the sandy mantle is less than 20 inches thick, and in some it is more than 40 inches thick.

Included with this soil in mapping are small areas of Alban, Croswell, and Iosco soils. The moderately well drained Alban soils are similar to the Alban Variant soil in position on the landscape but have no sandy mantle. The somewhat poorly drained Iosco soils are in lower positions in drainageways and depressions. The moderately well drained Croswell soils are similar to the Alban Variant soil in position on the landscape. Also included are small sloping areas and severely eroded areas of Alban Variant loamy sand and some very stony areas. These inclusions make up 10 to 15 percent of the unit.

In this Alban Variant soil permeability is rapid in the sandy mantle and moderate in the loamy subsoil and substratum. The available water capacity is moderate, and surface runoff from cultivated areas is medium. The water table is within 3 feet of the surface during wet seasons. Organic matter content of the surface layer is low or very low. The surface layer is very friable and is easily tilled.

Many areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to grasses and legumes for hay and pasture. It is suited to sprinkler irrigation, and with irrigation it can produce better and more consistent yields. Where cultivated, this soil has a slight hazard of erosion and is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production.

The use of this soil for pasture or hayland is also effective in controlling soil blowing. Forage yields are generally somewhat limited unless this soil is irrigated. Early spring plantings, before the surface layer has a chance to dry, are best on this soil. Later plantings are likely to have poor survival unless they are irrigated. Overgrazing leads to loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing will keep the vegetation in good condition.

This soil is suited to growing trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and because of the rapid permeability in the sandy upper part of the soil. These problems can be overcome by building a filtering mound of suitable material or pumping the effluent to an absorption field located nearby on a more suitable soil. This soil is suited to dwellings without basements and to local roads and streets. It is moderately suited to dwellings with basements because of the seasonal high water table. This problem can be overcome by installing a subsurface drainage system with gravity outlet or other dependable outlet, or by constructing the basement above the level of wetness.

This soil is in capability unit IIIe-4 and woodland suitability subclass 2o.

Ah—Angelica silt loam. This nearly level, poorly drained and very poorly drained soil is on low-lying flats and in depressions and drainageways. Most areas are irregular in shape, range from about 3 to 400 acres in size, and are subject to ponding.

Typically, the surface layer is black silt loam about 9 inches thick. The subsoil is about 14 inches thick. It is dark gray, mottled, friable loam in the upper part; light brown, mottled, firm loam in the middle; and reddish brown, mottled, firm loam in the lower part. The substratum, to a depth of about 60 inches, is reddish brown, mottled, friable loam in the upper part and reddish brown, mottled, friable sandy loam in the lower part. In some places the surface layer is loam, and in some areas this soil has an organic surface layer up to 16 inches thick. Also, in some places this soil is underlain by sand and gravel or stratified silt and fine sand.

Included with this soil in mapping are small areas of Bach, Cathro, and Solona soils. The very poorly drained Cathro soils are organic soils and are similar to the Angelica soil in position on the landscape. The poorly drained and very poorly drained Bach soils are in similar landscape positions but contain more silt and less sand and clay. The somewhat poorly drained Solona soils are in slightly higher landscape positions. Also included are small areas with dolomite bedrock at a depth of 40 to 60 inches. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderately slow in this Angelica soil. The available water capacity is high. Surface runoff is very slow or ponded. The water table is above or near the surface much of the year, unless drained. Depth of root penetration is limited by the water table. Organic matter content of the surface layer is high or very high. The surface layer is friable and is easily tilled, but it has a tendency to crust after hard rains.

Most drained areas are used for cropland. Undrained areas are generally unsuitable for crops. These areas provide wildlife habitat, and some are used for unimproved pastureland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage. Unless protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks will cave and plug the ditch.

Because of the high water table and periodic ponding, undrained areas of this soil are unsuitable for most forage species and are restricted to species such as reed canarygrass. Drained areas are suited to growing certain legumes and grasses. Overgrazing leads to a loss of plant cover and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction and results in poor tilth and reduced water infiltration. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Soil wetness generally requires the preparation of ridges and planting by hand or machine because natural regeneration is unreliable. Large vigorous nursery stock is essential. Harvest is frequently limited to frozen soil conditions. Harvest by clear-cut or area-selection methods will help reduce windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration or the establishment of plantings, can be controlled by the use of suitable herbicides or removed mechanically.

This soil is generally unsuited to septic tank absorption fields because of ponding and moderately slow permeability. This soil is generally unsuited to dwellings with or without basements because of ponding. These problems are difficult to overcome, and a more suitable site should be selected. This soil is poorly suited to local roads and streets because of ponding and high potential for frost action. The ponding problem can be overcome by removing surface water through suitable outlets with culverts and ditches or by using fill material to construct roads above the ponding level. Installing culverts can also help to prevent road damage by equalizing the water level on both sides of the road. The frost problem can be overcome by subsurface drainage of the roadbed and by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIw-1 and woodland suitability subclass 3w.

AtB—Antigo silt loam, 1 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on flats and 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 silt loam about 8 inches thick. The subsoil is about 29 inches thick. It is mostly dark brown, friable, silt loam in the upper part and dark brown, friable sandy loam in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand with strata of gravel. Some areas have slopes less than 1 percent. In some places the silty mantle is less than 20 inches thick and in some it is more than 36 inches thick.

Included with this soil in mapping are small areas of Brill and Rosholt soils. The moderately well drained Brill soils occupy landscape positions that are similar to, or slightly lower than, those of the Antigo soil. The well drained Rosholt soils are similar to the Antigo soil in position on the landscape but do not have the silty mantle. Also included are some very stony areas of Antigo soil and small areas with slopes greater than 6 percent. These inclusions make up 10 to 15 percent of the unit.

The permeability of this Antigo soil is moderate in the subsoil and rapid or very rapid in the substratum. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying sand and gravel. Organic matter content of the surface layer is moderate. The surface layer is friable and easily tilled. It tends to crust, however, after hard rains.

Some areas are used for crops and pasture. Some areas are in woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated there is a slight or moderate hazard of erosion. Erosion can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, contour stripcropping, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used for pasture and hayland, erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in erosion. Grazing, when the surface layer is wet, causes surface compaction that results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This may result in pollution of the ground water. This soil is suited to dwellings with basements. It is moderately suited to dwellings without basements because it lacks sufficient stability in the subsoil to support building foundations. This problem can be overcome by replacing the soil with a layer of sand or gravel under the footings and concrete slab. This soil is poorly suited to local roads and streets because of the high potential for frost action and because it lacks sufficient strength to support vehicular traffic. These problems can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIe-2 and woodland suitability subclass 1o.

AuA—Au Gres loamy sand, 0 to 3 percent slopes. This nearly level and gently sloping, 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 3 to 100 acres in size.

Typically, the surface layer is very dark brown loamy sand about 8 inches thick. The subsoil is about 29 inches thick. It is dark brown, mottled, very friable loamy sand and sand in the upper part and brown, mottled, very friable sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand. In some places the surface layer is sand, fine sand, or loamy fine sand.

Included with this soil in mapping are small areas of Croswell and Cormant soils. The moderately well drained Croswell soils occupy slightly higher positions in the landscape than do the Au Gres soil. The poorly drained and very poorly drained Cormant soils occupy lower landscape positions. Also included are small areas that are very stony. These inclusions make up 5 to 10 percent of the unit.

Permeability is rapid in this Au Gres soil. The available water capacity is low, and surface runoff is slow. The seasonal high water table is 1 to 3 feet below the surface during wet periods, unless drained. Organic matter content of the surface layer is moderate. Depth of root penetration is limited by the water table during wet periods of the growing season. The surface layer is very friable and is easily tilled.

Drained areas of this soil are used for crops and pasture. Undrained areas provide wildlife habitat, and some of these areas are used for unimproved pastureland. Some areas are in woodland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but yields during most seasons are limited by the low available water capacity. This soil is suited to sprinkler irrigation. With fertilization and irrigation, it produces better and more consistent yields. Both deep ditch and tile drainage are used for internal drainage of this soil. Loose sand, however, will enter the tile lines unless a suitable filter is used to cover the tile. Ditchbanks are easily eroded by flowing water unless protected by plant cover. Vertical banks will cave and plug the ditch. Erosion is generally not a problem on this soil, but drained and cultivated areas are subject to soil blowing. Soil blowing can be reduced by proper management of crop residue, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, wind stripcropping, and field windbreaks. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability of this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone and into the water table.

Where drained, this soil is suited to hayland and pasture, and these uses are effective in controlling soil blowing. Forage yields, however, are generally low unless this soil is fertilized and irrigated. Planting early in spring before the surface layer has a chance to dry is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to growing trees. Poor seedling survival rates in dry years can be offset by careful planting and the use of vigorous nursery stock. Competing vegetation that interferes with natural regeneration or the establishment of plantings can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and rapid permeability. Where the water table is at a depth of more than 2 feet, these problems can be overcome by building a filtering mound of suitable material. It may also be possible to pump the effluent to an absorption field located on higher, more suitable soils. This soil is poorly suited to dwellings with or without basements because of the seasonal high water table. This problem can be overcome by using fill material to raise the site above the level of wetness or by installing a subsurface drainage system with gravity outlet or other dependable outlet. This problem may also be overcome by using fill material to raise the site elevation and by constructing basements above the level of wetness. This soil is moderately suited to local roads and streets because of the seasonal high water table and moderate potential for frost action. The problem of wetness can be overcome by installing a subsurface drainage system to lower the water table or by using fill material to raise the roadbed above the wetness level. The frost problem can be overcome by draining the roadbed by subsurface drainage and by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IVw-5 and woodland suitability subclass 3s.

AxA—Au Gres Variant loamy fine sand, 0 to 3 percent slopes. This nearly level and gently sloping, 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 3 to 200 acres in size. Some areas are subject to flooding.

Typically, the surface layer is very dark gray loamy fine sand about 9 inches thick. The subsurface layer is dark grayish brown, mottled, very friable fine sand about 5 inches thick. The subsoil is about 14 inches thick. It is brown, mottled, very friable fine sand in the upper part and brown, mottled, very friable loamy sand in the lower part. The substratum, to a depth of about 60 inches, is grayish brown sand stratified with gravel. In some places the surface layer is loamy sand or sandy loam. In some places the soil does not have gravel in the substratum.

Included with this soil in mapping are small areas of Wheatley soils. The poorly drained and very poorly drained Wheatley soils are in lower landscape positions in drainageways and depressions. These inclusions make up 5 to 10 percent of the unit.

Permeability is rapid in this Au Gres Variant soil. The available water capacity is low, and surface runoff is slow. The seasonal high water table is 1 to 3 feet below the surface during wet seasons. Depth of root penetration is limited by the water table during wet periods of the growing season. Organic matter content of the surface layer is moderate. The surface layer is very friable and is easily tilled.

Drained areas are used for crops and pasture. Undrained areas provide wildlife habitat, and some of these areas are used for unimproved pasture. Some areas are in native woodland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage of this soil. Where tile drainage is used, loose sand will enter the tile lines unless a suitable filter is used to cover the tile. Unless protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks will cave and plug the ditch. Drained and cultivated areas of this soil are subject to soil blowing. Soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, wind stripcropping, and field windbreaks. Where the water table is lowered excessively, crop yields during most seasons are limited by low available water capacity. This soil is suited to sprinkler irrigation. Fertilization, irrigation, and controlled drainage are necessary for dependable crop production. Because of the rapid permeability of this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone and into the water table.

Where drained, this soil is suited to pasture and hayland, and these uses are also effective in controlling soil blowing. Forage yields, however, are generally low unless this soil is fertilized and irrigated. Planting early in spring before the surface layer has a chance to dry is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to growing trees. Competing vegetation that interferes with natural regeneration following harvest can be controlled by the use of suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table, flooding, and rapid permeability. Where the water table is at a depth of more than 2 feet these problems can be overcome by building a filtering mound of suitable material and by protecting the site from flooding. This soil is poorly suited to dwellings with or without basements because of the seasonal high water table and flooding. The wetness problem can be overcome by installing a subsurface drainage system with gravity outlet or other dependable outlet. This problem may also be overcome by using fill material to raise the site elevation and by constructing basements above the level of wetness. The flooding problem may be overcome by diverting water away from the dwelling with a diversion or dike and by shaping the construction site to remove surface water. This soil is moderately suited to local roads and streets because of the moderate potential for frost action, the seasonal high water table, and flooding. These problems can be overcome by using a coarse base material such as sand or gravel to raise the roadbed above the wetness level and by installing a subsurface drainage system. The flooding problem may require the installation of larger bridges or culverts to permit the floodwater to drain away.

This soil is in capability unit IVw-5 and woodland suitabilty subclass 3s.

Ba—Bach silt loam. This nearly level, poorly drained and very poorly drained soil is on low-lying flats and in depressions and drainageways. Most areas are irregular in shape, range from about 3 to 175 acres in size, and are subject to ponding.

Typically, the surface layer is black silt loam about 8 inches thick. The substratum, to a depth of about 60 inches, is gray and light brownish gray, mottled, friable, stratified layers of silt loam, very fine sandy loam, loamy very fine sand, and very fine sand. In some places the surface layer is mucky silt loam, mucky loam, or loam. Some areas have free carbonates at the surface, and some areas have no free carbonates within 60 inches of the surface.

Included with this soil in mapping are small areas of Cathro, Cormant, Markey, and Shiocton soils. The very poorly drained Cathro and Markey soils are organic and occupy landscape positions that are similar to, or slightly lower than, those of the Bach soil. The poorly drained and very poorly drained Cormant soils are similar to the Bach soil in position on the landscape but are sandy throughout. The somewhat poorly drained Shiocton soils are on slightly higher landscape positions. These inclusions make up 5 to 10 percent of the unit.

Permeability is moderate in this Bach soil. The available water capacity is high, and surface runoff is very slow or ponded. The water table is above or near the surface much of the year, unless drained. Depth of root penetration is limited by the water table. Organic matter content of the surface layer is high or very high. The surface layer is friable and can be easily tilled.

Some areas are drained and in crops or pasture. Undrained areas are generally unsuitable for cropland. Most of these areas are in woodland, and some are used for unimproved pasture. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage. Where tile is placed in the underlying stratified deposits, however, loose sand will enter the tile lines unless a suitable filter is used to cover the tile. Unless protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks will cave and plug the ditch.

Because of the high water table and periodic ponding, undrained areas of this soil are unsuitable for most forage species and are restricted to species such as reed canarygrass. With proper management, certain legumes and grasses can be grown successfully in drained areas of this soil. Overgrazing leads to a loss of plant cover and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction and results in poor tilth and reduced water infiltration. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and plant cover in good condition.

This soil is suited to growing trees. Soil wetness generally requires the preparation of ridges and planting by hand or machine if natural regeneration is unreliable. Use of vigorous nursery stock will reduce the mortality rate. Harvest is frequently limited to when the soil is frozen. Harvest by clear-cut or area-selection methods will help reduce windthrow of the remaining trees. Competing vegetation that 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 ponding. It is generally unsuited to dwellings with or without basements because of ponding. This problem is difficult to overcome for these uses, and a different site with suitable soil should be found. This soil is poorly suited to local roads and streets because of ponding and high potential for frost action. These problems can be overcome by removing surface water with culverts and ditches and by adding a coarse fill material such as sand or gravel to construct roads above the ponding level. Installing culverts can also help prevent road damage by equalizing the water level on both sides of the road.

This soil is in capability unit IIw-1 and woodland suitability subclass 3w.

BrB—Boyer sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on flats or convex side slopes. Most areas are irregular in shape and range from about 3 to 70 acres in size.

Typically, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 21 inches thick. It is brown and reddish brown, friable sandy loam and gravelly sandy loam. The substratum, to a depth of about 60 inches, is brown, loose sand, stratified with gravel. Some areas of this soil are eroded, and some are sloping. In some places the surface layer is fine sandy loam or loam.

Included with this soil in mapping are small areas of Lorenzo Variant soils. The well drained Lorenzo Variant soils are similar to the Boyer soil in position on the landscape, where the soil is less than 20 inches thick over sand and gravel. These inclusions make up 5 to 10 percent of the unit.

In this Boyer soil the permeability is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is low, and surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying sand and gravel. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled.

Most areas of this soil are in crops or pasture. Some areas are in woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields during most seasons are limited by low available water capacity. With irrigation and intensive management, this soil can produce better and more consistent yields. Where this soil is cultivated there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production.

This soil is suited to hay and pasture, but forage yields are generally somewhat limited unless it is fertilized and irrigated. Erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is suited to growing trees. Seedling survival rates can be improved by careful planting of vigorous nursery stock. Competing vegetation can slow natural regeneration or establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is suited to dwellings with or without basements and to local roads and streets. It is a probable source for sand and gravel.

This soil is in capability unit IIIs-4 and woodland suitability subclass 3o.

Bs—Brevort mucky loamy sand. This nearly level, poorly drained and very poorly drained soil is on low-lying flats and in depressions and drainageways. Most areas are irregular in shape, range from about 3 to 250 acres in size, and are subject to ponding.

Typically, the surface layer is very dark grayish brown mucky loamy sand about 8 inches thick. The substratum, to a depth of about 60 inches, is grayish brown and brown, mottled, very friable sand and loamy sand in the upper part and brown and yellowish red, mottled, firm loam and clay loam in the lower part. In some places the surface layer is sandy loam or loam; in other areas this soil has an organic surface layer up to 16 inches thick. In some places the sandy mantle is more than 40 inches thick. Also, in some places the lower substratum contains lenses of silty clay or very fine sand and in some places there are no free carbonates.

Included with this soil in mapping are small areas of Cormant, Iosco, and Markey soils. The poorly drained and very poorly drained Cormant soils are similar to the Brevort soil in position on the landscape but do not have the loamy substratum. The very poorly drained Markey soils are in slightly lower areas and have a 16- to 51-inch-thick organic layer. The somewhat poorly drained Iosco soils are on slightly higher landscape positions. Also included are small areas that are very stony. These inclusions make up 5 to 10 percent of the unit.

In this Brevort soil the permeability is rapid in the sandy mantle and moderately slow in the loamy substratum. The available water capacity is moderate, and surface runoff is very slow or ponded. The water table is above or near the surface throughout the year, unless drained. This limits the depth of root penetration. Organic matter content of the surface layer is high or very high. The surface layer is friable and easily tilled.

Most areas are undrained and are generally unsuited to crops. Undrained areas provide wildlife habitat, and some of these areas are used for unimproved pasture. A few areas have been drained and are used for corn and small grains and for legumes and grasses for hay and pasture. Drained and cultivated areas are subject to soil blowing.

Because of the high water table and periodic ponding, undrained areas of this soil are unsuitable for most forage plants. With good management and adequate drainage, this soil is suited to growing certain legumes and grasses. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is poorly suited to growing trees. Growth is so slow and form so poor that trees are barely merchantable at best. Soil wetness generally requires preparing ridges and planting by hand or machine if natural regeneration is unreliable. Use of vigorous nursery stock will reduce the mortality rate. Harvest is frequently limited to when the soil is frozen. Harvest by clear-cut or area-selection methods will help reduce windthrow of the remaining trees. Competing vegetation that interferes with natural regeneration or the establishment of plantings can be controlled through the use of suitable herbicides or removed mechanically.

This soil is generally unsuited to septic tank absorption fields because of ponding, rapid permeability in the upper part of the substratum, and moderately slow permeability in the lower part of the substratum. It is generally unsuited to dwellings with or without basements because of ponding. These problems are difficult to overcome, and a more suitable site should be selected. This soil is poorly suited to local roads and streets because of ponding and the high potential for frost action. These problems can be overcome by removing surface water with culverts and ditches and by adding a coarse fill material such as sand or gravel to construct roads above the ponding level. Installing culverts can also help prevent road damage by equalizing the water level on both sides of the road.

This soil is in capability unit VIw-5, undrained. It is in woodland suitability subclass 4w.

BtA—Briggsville silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on flats. Most areas are irregular in shape and range from about 3 to 150 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 20 inches thick. It is reddish brown, very firm silty clay. The substratum, to a depth of about 60 inches, is reddish brown, very firm silty clay. Some areas of this soil are gently sloping. In some places the subsoil and the substratum have strata of silt loam or silty clay loam.

Included with this soil is mapping are small areas of Manawa and Menominee soils. The somewhat poorly drained Manawa soil is in lower areas in drainageways and depressions. The well drained Menominee soil is similar to the Briggsville soil in position on the landscape but has a 20- to 40-inch-thick sandy mantle. Also included are small areas where the subsoil is less than 35 percent clay. These inclusions make up 5 to 10 percent of the unit.

Permeability is moderately slow in this Briggsville soil. The available water capacity is moderate or high. Surface runoff is slow. Organic matter content of the surface layer is moderately low and moderate. The surface layer is friable and can be easily tilled. It tends to crust, however, after hard rains.

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Erosion is generally not a problem on this soil. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

This soil is suited to pasture or hay. Overgrazing, however, leads to a loss of plant cover and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the moderately slow permeability. This problem can be overcome by building a filtering mound of suitable material or by increasing the size of the absorption field. This soil is moderately suited to dwellings with or without basements because it lacks sufficient stability to adequately support building foundations. This problem can be overcome by replacing the soil with a coarse material such as sand or gravel under the footings and concrete slab. This soil is poorly suited to local roads and streets because it lacks sufficient strength to adequately support vehicular traffic. This problem can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel. The low strength problem can also be overcome by increasing the thickness of pavement, base, and subbase materials.

This soil is in capability unit IIs-7 and woodland suitability subclass 2o.

BtB—Briggsville silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 160 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil is about 28 inches thick. It is reddish brown, firm silty clay and silty clay loam. The substratum, to a depth of about 60 inches, is reddish brown, firm silty clay loam. Some areas of this soil are nearly level. In some places the substratum has strata of silt loam.

Included with this soil in mapping are small areas of Manawa and Menominee soils. The somewhat poorly drained Manawa soil is in lower areas in drainageways and depressions. The well drained Menominee soil is similar to the Briggsville soil in position on the landscape but has a 20- to 40-inch-thick sandy mantle. Also included are small areas with slopes greater than 6 percent and some areas where the subsoil is less than 35 percent clay. These inclusions make up 5 to 10 percent of the unit.

Permeability is moderately slow in this Briggsville soil. The available water capacity is high or moderate. Surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled. It tends to crust, however, after hard rains.

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a slight or moderate hazard of erosion. Erosion can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, contour stripcropping, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used for pasture or hay, erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in erosion. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the moderately slow permeability. This problem can be overcome by building a filtering mound of suitable material. This soil is moderately suited to dwellings with or without basements because it lacks sufficient stability to adequately support building foundations. This problem can be overcome by replacing the soil with a coarse material such as sand or gravel under the footings and concrete slab. This soil is poorly suited to local roads and streets because it lacks sufficient strength to adequately support vehicular traffic. This problem can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel. The low strength problem can also be overcome by increasing the thickness of pavement, base, and subbase materials.

This soil is in capability unit IIe-6 and woodland suitability subclass 2o.

BuA—Brill silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, moderately well drained soil is on flats, foot slopes, and 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 grayish brown silt loam about 7 inches thick. The subsurface layer is pale brown, friable silt loam about 5 inches thick. The subsoil is about 26 inches thick. It is yellowish brown, friable silt loam in the upper part and yellowish brown loam in the lower part. The subsoil is mottled in the lower 9 inches. The substratum, to a depth of about 60 inches, is yellowish brown, loose gravelly sand. Some small areas have slopes greater than 3 percent. In some small areas the silty mantle is more than 36 inches thick, and in some the silty mantle contains very thin sandy or loamy strata. Also, in some places the subsoil contains more sand and less silt than typical.

Included with this soil in mapping are small areas of Antigo and Oesterle soils. The well drained Antigo soils occupy slightly higher landscape positions than does the Brill soil. The somewhat poorly drained Oesterle soils occupy slightly lower positions in drainageways and depressions. Also included are some areas of Brill soils that are very stony. These inclusions make up 5 to 10 percent of the unit.

In this Brill soil the permeability is moderate in the subsoil and rapid or very rapid in the substratum. The available water capacity is moderate, and surface runoff is slow. The water table is as shallow as 3 feet below the surface during wet seasons. Depth of root penetration is limited by the underlying sand and gravel. Organic matter content of the surface layer is moderate. The surface layer is friable and is easily tilled. It tends to crust, however, after hard rains.

Some areas are used for crops and pasture, and some are in woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Erosion is generally not a problem on this soil. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

This soil is suited to pasture and hay. Overgrazing, however, leads to a loss of plant cover and encourages undesirable species. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and rapid or very rapid permeability in the substratum. These problems can be overcome by building a filtering mound of suitable material. This soil is moderately suited to dwellings without basements because it lacks sufficient stability to adequately support building foundations. This problem can be overcome by replacing the soil with a coarse material such as sand or gravel under the footings or concrete slab. This soil is also moderately suited to dwellings with basements because of the seasonal high water table. This problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet or by constructing the basement above the level of wetness. This soil is poorly suited to local roads and streets because of high potential for frost action and because it lacks sufficient strength to adequately support vehicular traffic. These problems can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel and by subsurface draining of the roadbed. The low strength problem can also be overcome by increasing the thickness of pavement, base, and subbase materials.

This soil is in capability unit IIs-1 and woodland suitability subclass 2o.

Co—Cormant mucky loamy fine sand. This nearly level, poorly drained and very poorly drained soil is on low-lying flats and in depressions and drainageways. Most areas are irregular in shape, range from about 3 to 500 acres in size, and are subject to flooding or ponding, or both.

Typically, the surface layer is black mucky loamy fine sand about 8 inches thick. The substratum, to a depth of about 60 inches, is dark grayish brown, mottled, loose loamy fine sand in the upper part and is light brownish gray, dark grayish brown, and dark gray, mottled, loose fine sand in the lower part. In some places the surface layer is fine sand, loamy fine sand, sand, loamy sand, or mucky fine sand. Some areas have an organic surface layer up to 16 inches thick.

Included with this soil in mapping are small areas of Au Gres, Brevort, Markey, and Wainola soils. The very poorly drained Markey soils are similar to the Cormant soil in position on the landscape but have a 16- to 51-inch-thick organic layer. The somewhat poorly drained Au Gres and Wainola soils are in slightly higher landscape positions. The poorly drained and very poorly drained Brevort soils are similar to the Cormant soil in position on the landscape but have a loamy substratum at depths of 20 to 40 inches. Also included are small areas that are very stony. These inclusions make up about 5 to 10 percent of the unit.

Permeability is rapid in this Cormant soil. The available water capacity is low. Surface runoff is very slow or ponded. Unless this soil is drained, the water table is above or near the surface throughout the year. This limits the depth of root penetration. Organic matter content of the surface layer is high or very high. The surface layer is very friable and can be easily tilled.

Most areas are undrained and are generally unsuited to crops. Undrained areas provide wildlife habitat, and some are used for unimproved pasture. A few areas have been drained and are used for corn and small grains. Drained and cultivated areas of this soil are subject to soil blowing.

Undrained areas of this soil are unsuitable for most forage plants. Where drained, this soil is suited to certain legumes and grasses for hay and pasture. Forage yields are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, are best on drained areas of this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is poorly suited to woodland. Growth is so slow and form so poor that trees are barely merchantable at best. Soil wetness generally requires preparing ridges and planting by hand or machine if natural regeneration is unreliable. Large, vigorous nursery stock is essential to avoid mortality. Harvest is frequently limited to when the soil is frozen. Harvest by clear-cut or area-selection methods will help reduce windthrow of the remaining trees. Competing vegetation that 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 ponding and rapid permeability. It is generally unsuited to dwellings with or without basements because of flooding and ponding. These problems are difficult to overcome, and a more suitable site should be selected. This soil is poorly suited to local roads and streets because of ponding. This problem can be overcome by removing surface water with culverts and ditches and by adding fill material to construct roads above the ponding level. Installing culverts can also help prevent road damage by equalizing the water level on both sides of the road.

This soil is in capability unit IVw-6, undrained. It is in woodland suitability subclass 3w.

CrB—Cromwell sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping, excessively drained soil is on flats and convex side slopes. Most areas are irregular in shape and range from about 3 to 230 acres in size.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. The subsoil is about 33 inches thick. It is dark brown, friable sandy loam in the upper part; dark brown, very friable loamy sand in the middle part; and dark brown, loose sand in the lower part. The substratum, to a depth of about 60 inches, is brown and light brown, loose sand. Some small areas are eroded. In some places the surface layer and the upper part of the subsoil are loam, silt loam, or fine sandy loam. In some areas, the loamy mantle is more than 24 inches thick, and in some there is an horizon of clay accumulation. Also, in some places the substratum is stratified sand and gravel.

Included with this soil in mapping are small areas of Menahga and Mahtomedi soils. The excessively drained Menahga soils are similar to the Cromwell soil in position on the landscape but are sandy throughout. The excessively drained Mahtomedi soils are in similar landscape positions but are sandy and gravelly throughout the soil. Other inclusions are small sloping areas of Cromwell sandy loam and some areas that are very stony. Also included are small areas where granite bedrock is at a depth of 40 to 60 inches. These inclusions make up about 10 to 15 percent of the unit.

In this Cromwell soil the permeability is moderate in the upper part of the subsoil and rapid in the lower part of the subsoil and in the substratum. The available water capacity is low, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and is easily tilled.

Most areas of this soil are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields during most seasons are limited by low available water capacity. With irrigation, this soil can produce better and more consistent yields. Where this soil is cultivated, there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production.

This soil is suited to hay and pasture, but forage yields are generally somewhat limited unless this soil is fertilized and irrigated. Erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields, but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is suited to dwellings with or without basements and to local roads and streets.

This soil is in capability unit IIIe-12 and woodland suitability subclass 2o.

CrC—Cromwell sandy loam, 6 to 12 percent slopes. This sloping, excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 30 acres in size.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 32 inches thick. It is dark brown, friable sandy loam in the upper part; dark brown, very friable loamy sand in the middle part; and brown, loose sand in the lower part. The substratum, to a depth of about 60 inches, is brown and light brown, loose sand. Some small areas are eroded. In some places the surface layer and the upper part of the subsoil are loam, silt loam, or fine sandy loam. In some areas, the loamy mantle is more than 24 inches thick and in some there is an horizon of clay accumulation. Also, in some places the substratum is stratified sand and gravel.

Included with this soil in mapping are small areas of Menahga and Mahtomedi soils. The excessively drained Menahga soils are similar to the Cromwell soil in position on the landscape but are sandy throughout. The excessively drained Mahtomedi soils are in similar landscape positions but are sandy and gravelly throughout. Other inclusions are small gently sloping and moderately steep areas of Cromwell sandy loam and some areas that are very stony. Also included are small areas that have granite bedrock at a depth of 40 to 60 inches. These inclusions make up about 10 to 15 percent of the unit.

In this Cromwell soil the permeability is moderate in the upper part of the subsoil and rapid in the lower part of the subsoil and in the substratum. The available water capacity is low, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and is easily tilled.

Most areas of this soil are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields during most seasons are limited by low available water capacity. With irrigation, this soil can produce better and more consistent yields. Where this soil is cultivated, there is a moderate hazard of erosion and this soil is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production.

This soil is suited to hay and pasture, but forage yields are generally somewhat limited unless this soil is fertilized and irrigated. Erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is moderately suited to dwellings with or without basements because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material, or by constructing dwellings to conform to the slope by using piles or columns. This soil is also moderately suited to local roads and streets because of the slope. This problem can be overcome by shaping the site by cutting or cutting and adding fill material to a more suitable slope or by constructing roads on the contour.

This soil is in capability unit IVe-12 and woodland suitability subclass 2o.

CrD—Cromwell sandy loam, 12 to 20 percent slopes. This moderately steep, excessively 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 7 inches thick. The subsoil is about 28 inches thick. It is dark brown, friable sandy loam in the upper part; dark brown, very friable loamy sand in the middle part; and brown, loose sand in the lower part. The substratum, to a depth of about 60 inches, is brown and light brown, loose sand. Some small areas are eroded. In some places the surface layer and the upper part of the subsoil are loam, silt loam, or fine sandy loam. In some areas, the loamy mantle is more than 24 inches thick and in some there is an horizon of clay accumulation. Also, in some places the substratum is stratified sand and gravel.

Included with this soil in mapping are small areas of Menahga and Mahtomedi soils. The excessively drained Menahga soils are similar to the Cromwell soil in position on the landscape but are sandy throughout. The excessively drained Mahtomedi soils are in similar landscape positions but are sandy and gravelly throughout. Other inclusions are small sloping areas and steep areas of Cromwell sandy loam and some areas that are very stony. Also included are small areas with slopes greater than 20 percent and small areas where granite bedrock is at a depth of 40 to 60 inches. These inclusions make up about 10 to 15 percent of the unit.

In this Cromwell soil the permeability is moderate in the upper part of the subsoil and rapid in the lower part of the subsoil and in the substratum. The available water capacity is low, and surface runoff from cultivated areas is rapid. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and is easily tilled.

Some areas of this soil are used for crops and pasture. Some areas are in native woodland. This soil is generally unsuited to growing cultivated crops but is suited to legumes and grasses for hay and pasture. Crop yields during most seasons are limited by low available water capacity. Where this soil is cultivated, there is a severe hazard of erosion and this soil is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways.

Use of this soil for pasture or hayland is also effective in controlling erosion and soil blowing, but forage yields are generally limited by low available water capacity. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to growing trees. Soil-related problems of forest management are associated with steepness of slope or plant competition following harvest. Planting trees on the contour and careful location of skid roads during harvest will minimize erosion. Seedling survival rates on steeper slopes facing south or west can be improved by care in planting and use of vigorous planting stock. Competing vegetation that interferes with natural regeneration following harvest can be controlled by suitable herbicides or mechanical removal. Skidding operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to septic tank absorption fields because of the slope. The slope problem can be overcome by shaping the land at the site by cutting and adding fill material to get a suitable slope or by selecting a less sloping site. The soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of ground water pollution. The soil is poorly suited to dwellings with or without basements and local roads and streets because of the slope. This problem can be overcome by shaping the land by cutting or cutting and adding fill material to get a suitable slope or by selecting a less sloping site. Local roads and streets can also be constructed on the contour.

This soil is in capability unit VIe-12 and woodland suitability subclass 2r.

CtA—Croswell loamy sand, 0 to 3 percent slopes. This nearly level and gently sloping, moderately well 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 3 to 300 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is brown loamy sand about 3 inches thick. The subsoil is about 24 incnes thick. It is dark reddish brown, very friable loamy sand in the upper part; dark brown, loose sand in the middle part; and strong brown, mottled, loose sand in the lower part. The substratum, to a depth of about 60 inches, is yellowish brown, mottled, loose sand. Some small areas are eroded, mainly because of soil blowing, and some areas have slopes greater than 3 percent. In some places the surface layer is loamy fine sand, sand, or fine sand and in some places the soil is dominantly fine sand throughout.

Included with this soil in mapping are small areas of Au Gres, Menahga, and Rubicon soils. The somewhat poorly drained Au Gres soils are slightly lower than the Croswell soil in position on the landscape and are in drainageways and depressions. The excessively drained Menahga and Rubicon soils are in slightly higher landscape positions. Also included are small areas that are very stony. These inclusions make up 5 to 10 percent of the unit.

Permeability is rapid in this Croswell soil. The available water capacity is low, and surface runoff is very slow. This soil has a water table at depths as shallow as 3 feet during wet seasons. Organic matter content of the surface layer is low or very low. The surface layer is very friable and is easily tilled.

Some areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to grasses and legumes for hay and pasture, but crop yields are generally limited by the low available water capacity. This soil is suited to sprinkler irrigation, however, and with fertilization and irrigation it can produce better and more consistent yields. Erosion is generally not a problem, but this soil is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability of this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Where this soil is used as hayland and pasture, soil blowing is generally not a problem. Forage yields, however, are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, irrigation, and controlled grazing help to maintain plant cover.

This soil is suited to growing trees. Poor seedling survival rates in dry years can be offset by careful planting and use of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration, can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and rapid permeability. These problems can be overcome by building a filtering mound of suitable material. This soil is suited to dwellings without basements and local roads and streets. It is only moderately suited to dwellings with basements because of the seasonal high water table. This problem can be overcome by installing a subsurface drainage system with gravity outlet or other dependable outlet, or by constructing the basement above the level of wetness.

This soil is in capability unit IVs-4 and woodland suitability subclass 2s.

Dp—Dumps. These are areas where trash, garbage, and industrial wastes have been deposited. Most areas are rectangular or rounded in shape and range from about 3 to 25 acres in size.

Dumps contain a wide variety of materials. Some areas are active municipal sanitary landfills that are covered intermittently with soil materials. This results in cells of compacted waste. Some areas are sites where rubbish was randomly dumped. Other areas are primarily deposits of refuse from wood processing industries. All dumps have several to many feet of accumulated wastes. Dumps are associated with many kinds of soil. Some are on uplands and are in well drained mineral soils. Some are on low areas in wet mineral soils. Others are in depressional areas adjacent to very poorly drained organic soils.

Included with this unit in mapping are areas of spoil, which includes soil pushed from the dump area or brought in for covering the refuse.

Most dumps are still in use, but some have been partially filled and covered with soil.

The main management concern involves covering the filled dumps with soil and smoothing the area. The addition of suitable topsoil may be necessary to establish a plant cover.

Because of the diverse makeup of refuse and the possible presence of toxic wastes and hazardous materials, onsite investigations should be made to evaluate dump areas for any specific use. Dumps are not assigned to a capability unit or a woodland suitability subclass.

EcD—Elderon-Rosholt complex, 12 to 20 percent slopes. This unit consists of moderately steep, somewhat excessively drained and well drained soils on convex side slopes. Most areas are irregular in shape and range from about 5 to 80 acres in size. Mapped areas are 40 to 80 percent Elderon soil and 20 to 50 percent Rosholt soil. Areas of the two soils occupy similar positions on the landscape and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Elderon soil has a very dark grayish brown, gravelly sandy loam surface layer about 7 inches thick. The subsoil is about 37 inches thick. It is dark reddish brown, very friable very cobbly coarse sandy loam in the upper part; dark brown, very friable very cobbly loamy coarse sand in the middle part; and brown, very friable very cobbly loamy coarse sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose very cobbly coarse sand. In some places the surface layer is silt loam, loam, or fine sandy loam; in some places it is cobbly.

Typically, the Rosholt soil has a dark brown, sandy loam surface layer about 8 inches thick. The subsurface layer is about 5 inches thick. It is brown, friable sandy loam. The subsoil is about 21 inches thick. It is mostly brown, friable sandy loam in the upper part and is strong brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is strong brown and yellowish brown, loose sand and gravel. In some places the surface layer is loam, silt loam, or fine sandy loam.

Included with this unit in mapping are small areas of Mahtomedi and Menahga soils. The excessively drained Mahtomedi and Menahga soils are similar to the Elderon and Rosholt soils in position on the landscape but are sandy throughout. In addition, Menahga soils have fewer coarse fragments. Also included are small sloping areas, steep areas, and severely eroded areas and some areas of Elderon and Rosholt soils that are very stony. These inclusions make up 5 to 10 percent of the unit.

Permeability of the Elderon soil is rapid in the subsoil and very rapid in the substratum. Permeability of the Rosholt soil is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is very low in the Elderon soil and low in the Rosholt soil. Surface runoff from cultivated areas is rapid. Depth of root penetration is limited by the underlying cobbly coarse sand or sand and gravel. Organic matter content of the surface layer is moderately low or moderate.

Some areas are used for crops and pasture, and some are in native woodland. These soils are generally unsuited to cultivated crops but are suited to growing legumes and grasses for hay and pasture. Crop yields during most seasons are limited by the very low or low available water capacity. Where these soils are cultivated there is a severe hazard of erosion, and these soils are subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways.

The use of these soils as pasture and hayland is also effective in controlling erosion and soil blowing, but forage yields are generally limited by the very low or low available water capacity. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

These soils are suited to growing trees. Soil-related problems of forest management are associated with steepness of slope; mortality of seedlings on hot, dry sites; and brush encroachment following harvest. Planting trees on the contour and careful location of skid roads during harvest will minimize erosion and improve equipment trafficability. Seedling mortality rates on south- and west-facing slopes can be reduced by careful planting and use of vigorous nursery stock. Vegetation that competes with planted seedlings or natural reproduction following harvest can be controlled through the use of suitable herbicides or can be removed mechanically.

These soils are poorly suited to septic tank absorption fields because of the slope. The slope problem can be overcome by shaping the land at the site by cutting and adding fill material to get a suitable slope, or a less sloping site can be selected. These soils readily accept the effluent from septic tank absorption fields but do not adequately filter it. This results in a danger of ground water pollution. These soils are poorly suited to dwellings with or without basements and to local roads and streets because of the slope. This problem can be overcome by shaping the land to get a suitable slope or by constructing roads on the contour.

These soils are in capability unit VIIs-7. The Elderon soil is in woodland suitability subclass 3r; the Rosholt soil is in 2r.

EcE—Elderon-Rosholt complex, 20 to 35 percent slopes. This unit consists of steep and very steep, somewhat excessively drained and well drained soils on convex side slopes. Most areas are long and narrow in shape and range from about 3 to 120 acres in size.

Mapped areas are 40 to 80 percent Elderon soil and 20 to 50 percent Rosholt soil. Areas of these two soils occupy similar positions in the landscape and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Elderon soil has a very dark brown, gravelly sandy loam surface layer about 3 inches thick. The subsurface layer is grayish brown, very friable gravelly loamy sand about 3 inches thick. The subsoil is about 37 inches thick. It is dark reddish brown, very friable very cobbly coarse sandy loam in the upper part and dark brown, very friable very cobbly loamy coarse sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose very cobbly coarse sand. In some places the surface layer is gravelly loamy sand or gravelly loam, and in some places it is cobbly.

Typically, the Rosholt soil has a very dark grayish brown, sandy loam surface layer about 4 inches thick. The subsurface layer is brown, friable sandy loam about 6 inches thick. The subsoil is about 21 inches thick. It is brown, friable sandy loam in the upper part and strong brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is strong brown, loose gravelly sand in the upper part and brown loose sand in the lower part.

Included with this unit in mapping are small areas of Kennan, Mahtomedi, and Menahga soils. The well drained Kennan soils are similar to the Elderon and Rosholt soils in position on the landscape but formed in glacial till. The excessively drained Mahtomedi and Menahga soils are in similar landscape positions but are sandy throughout. In addition, Menahga soils have fewer coarse fragments. Also included are small moderately steep areas and severely eroded areas and some areas with slopes greater than 35 percent. Some very stony areas are also included. These inclusions make up 10 to 15 percent of the unit.

Permeability of the Elderon soil is rapid in the subsoil and very rapid in the substratum. Permeability of the Rosholt soil is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is very low in the Elderon soil and low in the Rosholt soil. Surface runoff from cultivated areas is very rapid. Depth of root penetration is limited by the underlying cobbly coarse sand or sand and gravel. Organic matter content of the surface layer is moderately low or moderate.

Most areas are used for woodland, but some are used for pasture. These soils are generally unsuitable for growing cultivated crops because of the very low or low available water capacity, soil blowing hazard, and very severe hazard of erosion. They are suited to pasture, but forage yields are generally limited by droughtiness. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

These soils are suited to growing trees. Soil-related problems of forest management are associated with steepness of slope; mortality of seedlings on hot, dry sites; and brush encroachment following harvest. Planting trees on the contour and careful location of skid roads during harvest will minimize erosion. Seedling survival rates on south- and west-facing slopes may be improved by careful planting and use of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by suitable herbicides or mechanical removal. Skidding operations may expose sufficient mineral soil to allow adequate regeneration.

These soils are generally unsuited to septic tank absorption fields and dwellings with or without basements because of slope. This problem is difficult to overcome, and a more suitable site should be selected. These soils are poorly suited to local roads and streets because of slope. This problem can be overcome by shaping the land to get a suitable slope or by constructing roads on the contour.

These soils are in capability unit VIIs-7. The Elderon soil is in woodland suitability subclass 3r; the Rosholt soil is in 2r.

FpB—Fairport fine sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on plane or convex ridgetops and 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 grayish brown fine sandy loam about 9 inches thick. The subsurface layer is brown, friable loam about 2 inches thick. The subsoil is about 19 inches thick. It is reddish brown, firm clay loam in the upper part and reddish brown, friable loam in the lower part. The substratum, to a depth of about 38 inches, is reddish brown, friable sandy loam. Light yellowish brown dolomite bedrock is at a depth of about 38 inches. Some small areas are eroded, and some have slopes of less than 1 percent. In some places the surface layer is fine sandy loam or silt loam. Also, some areas of this soil are more than 40 inches deep over dolomite bedrock.

Included with this soil in mapping are small areas of Onaway and Onaway cobbly substratum soils. The well drained Onaway and Onaway cobbly substratum soils are similar to the Fairport soil in position on the landscape but have no underlying dolomite. Also included are small sloping areas and severely eroded areas of Fairport fine sandy loam and small areas where the soil is less than 20 inches deep over dolomite bedrock. These inclusions make up 5 to 10 percent of the unit.

Permeability is moderate in this Fairport soil. The available water capacity is moderate or low, and surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying dolomite bedrock. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and easily tilled.

Most areas of this soil are in crops or pasture. Some small areas are in woodland. This soil is suited to corn and small grains and to grasses and legumes for hay or pasture. Where cultivated, this soil has a slight or moderate hazard of erosion. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Returning crop residues to the soil or the regular addition of other organic matter helps to increase fertility, reduce erosion, and increase water infiltration.

Where this soil is used as pasture and hayland, erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in erosion. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. The only soil-related forest management problem is competing vegetation, which interferes with natural regeneration following harvest. This vegetation can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the depth to bedrock. This problem can be overcome by building a filtering mound of suitable material. This soil is moderately suited to dwellings without basements because of depth to bedrock and because it lacks sufficient stability in the subsoil to adequately support building foundations. These problems can be overcome by excavating the bedrock by blasting and backfilling with a coarse material such as sand or gravel to form a level base deep enough for footings. The soil is poorly suited to dwellings with basements because of depth to bedrock. This problem can be overcome by excavating the bedrock by blasting, raising the site elevation by adding fill material, or by constructing a partially exposed basement to avoid excavating the bedrock. This soil is poorly suited to local roads and streets because it lacks sufficient strength in the subsoil to adequately support vehicular traffic. This problem can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse material such as sand or gravel. The low strength problem can also be overcome by increasing the thickness of pavement, base, and subbase materials.

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

FpC—Fairport fine sandy loam, 6 to 15 percent slopes. This sloping and moderately steep, well drained soil is on convex ridgetops and side slopes. Most areas are irregular in shape and range from about 3 to 50 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsoil is about 20 inches thick. It is brown, friable loam in the upper part; reddish brown, firm clay loam in the middle part; and reddish brown, friable loam in the lower part. The substratum, to a depth of about 34 inches, is reddish brown, friable sandy loam. Light yellowish brown dolomite bedrock is at a depth of about 34 inches. Some small areas of this soil are eroded. In some places the surface layer is fine sandy loam or silt loam. Also, some areas of this soil are more than 40 inches deep over dolomite bedrock.

Included with this soil in mapping are small areas of Onaway and Onaway cobbly substratum soils. The well drained Onaway and Onaway cobbly substratum soils are similar to the Fairport soil in position on the landscape but have no underlying dolomite. Also included are small gently sloping areas and severely eroded areas of Fairport fine sandy loam. Small areas are also included where slopes are greater than 15 percent or where the soil is less than 20 inches deep over dolomite bedrock. These inclusions make up 5 to 10 percent of the unit.

Permeability is moderate in this Fairport soil. The available water capacity is moderate, and surface runoff from cultivated areas is medium or rapid. Depth of root penetration is limited by the underlying dolomite bedrock. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled.

Most areas of this soil are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to grasses and legumes for hay and pasture. Where this soil is cultivated, there is a moderate or severe hazard of erosion. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture or hayland, erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in erosion. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically. In moderately steep areas of this soil, planting trees on the contour and careful location of skid roads during harvest will minimize erosion and improve equipment trafficability. Seedling mortality rates on south- and west-facing slopes can be reduced by careful planting and use of vigorous nursery stock.

This soil is poorly suited to septic tank absorption fields because of the depth to bedrock. This problem can be overcome by building a filtering mound of suitable material. In most instances, a less sloping site with a thicker soil over the rock should be located for this purpose. This soil is moderately suited to dwellings without basements because of slope and depth to bedrock and because the soil lacks sufficient stability to adequately support building foundations. The depth to bedrock and instability problems can be overcome by excavating the bedrock by blasting and backfilling with a coarse material such as sand or gravel to form a level base deep enough for footings or by adding fill material to increase the depth to bedrock. The slope problem can be overcome by cutting or cutting and adding fill material to get a suitable slope, but bedrock may prevent cuts of adequate depth. This soil is poorly suited to dwellings with basements because of the depth to bedrock. This problem can be overcome by excavating the bedrock by blasting, raising the site elevation by adding fill material, or by constructing a partially exposed basement to avoid excavating the bedrock. This soil is poorly suited to local roads and streets because it lacks sufficient strength to adequately support vehicular traffic. This problem can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse material such as sand or gravel.

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

Fu—Fordum loam. This nearly level, poorly drained and very poorly drained soil is on nearly level flood plains and in drainageways. This soil is subject to flooding. Many areas are dissected by old stream channels. Most areas are long and narrow in shape and range from about 3 to 1,650 acres in size.

Typically, the surface layer is very dark brown loam about 8 inches thick. The substratum, to a depth of about 60 inches, is dark grayish brown, mottled, friable loam in the upper part; grayish brown, mottled, very friable very fine sandy loam with thin strata of loam in the middle part; and dark grayish brown, loose sand in the lower part. Some areas have an organic surface layer up to 15 inches thick, and some have organic layers in the substratum.

Included with this soil in mapping are small areas of Cathro, Markey, and Seelyeville soils and Fluvents, loamy. The very poorly drained Cathro, Markey, and Seelyeville soils are similar to the Fordum soil in position on the landscape but have little or no alluvial deposition. The moderately well drained and somewhat poorly drained Fluvents, loamy, are in slightly higher areas. These inclusions make up about 10 to 20 percent of the unit.

Permeability in this Fordum soil is moderate in the loamy upper part and rapid in the sandy lower part. The available water capacity is moderate. Organic matter content of the surface layer is high. Surface runoff is very slow. Unless drained, the water table is at or near the surface much of the year. This limits the depth of root penetration.

Most areas are used for woodland, wildlife habitat, or unimproved pasture. This soil is generally unsuitable for cultivated crops because of the high water table and frequent flooding. Most areas are not feasible to drain.

Because of the high water table and frequent flooding, this soil is unsuitable for most forage species and is restricted to species such as reed canarygrass. Where drained and protected from flooding, however, it is suited to species such as alfalfa and red clover. Overgrazing leads to a loss of plant cover and encourages undesirable plant species. Loss of plant cover can also result in erosion during periods of overflow. Grazing when the surface is wet causes surface compaction in some areas of this soil and results in poor tilth. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Soil wetness generally requires preparing ridges and planting by hand or machine if natural regeneration is unreliable. Use of vigorous nursery stock will reduce the mortality rate. Harvest is frequently limited to when the soil is frozen. Harvest by clear-cut or area-selection methods will help reduce windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration or establishment of plantings, can be controlled by suitable herbicides or removed mechanically.

This soil is generally unsuited to septic tank absorption fields, dwellings with or without basements, and local roads and streets because of flooding, ponding, and wetness. These problems are difficult to overcome, and a more suitable site should be selected.

This soil is in capability unit Vw-1 and woodland suitability subclass 3w.

Fx—Fluvents, loamy. These nearly level and gently sloping, moderately well drained and somewhat poorly drained soils are on flood plains and in drainageways and depressions. They are subject to flooding. Many areas are dissected by old stream channels. Most areas are long and narrow in shape and range from about 3 to 80 acres in size.

These soils have a wide range in color, texture, and thickness of horizons. Texture of the surface layer is silt loam, loam, sandy loam, fine sandy loam, or loamy sand. The soil below the surface layer is dominantly stratified loamy and silty layers, with sandy layers in some pedons.

Included with these soils in mapping are small areas of Fordum and Oesterle soils. The poorly drained and very poorly drained Fordum soils are slightly lower than the Fluvents, loamy, in position on the landscape. The somewhat poorly drained Oesterle soils are similar to the Fluvents, loamy, in position on the landscape but have little or no alluvial deposition. These inclusions make up 10 to 15 percent of the unit.

Permeability in these Fluvents, loamy, ranges from moderately slow to moderately rapid. The available water capacity and organic matter content of the surface layer all range from high to low. Surface runoff is very slow. Unless drained, some areas of these soils have a seasonal high water table at a depth of 1 to 3 feet during wet seasons. In other areas the water table is at a depth of 3 to 5 feet during wet seasons. Depth of root penetration is limited by the water table during wet periods of the growing season.

Most areas are used for woodland, wildlife habitat, or unimproved pasture. Where these soils are adequately drained and protected from flooding, most areas are suited to corn and small grains and to grasses and legumes for hay and pasture. It is not feasible to drain some areas of these soils. Where drainage is feasible, however, both deep ditch and tile drainage are used for internal drainage. In some areas, loose sand will enter the tile lines unless the tile is covered with a suitable filter. Ditchbanks are easily eroded unless they are protected by plant cover, and vertical banks will cave and plug the ditch.

Where adequately drained and protected from flooding, these soils are suited to pasture and hayland. Overgrazing leads to a loss of plant cover and encourages undesirable plant species. Loss of plant cover can also result in erosion during periods of overflow. Grazing when the surface layer is wet causes surface compaction in some areas of these soils and results in poor tilth.

These soils are so variable that they are difficult to manage for woodland. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

These soils are generally unsuited to septic tank absorption fields, dwellings with or without basements, and local roads and streets because of the seasonal high water table and flooding. These problems are difficult to overcome for these uses, and a more suitable site should be selected.

These soils are in capability unit IIIw-12. They are not assigned to a woodland suitability subclass.

IsA—Iosco loamy sand, 0 to 3 percent slopes. This nearly level and gently sloping, 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 3 to 330 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsoil is about 38 inches thick. The upper part is brown, mottled, very friable loamy sand about 16 inches thick; the lower part is mostly reddish brown, mottled, friable loam. The substratum, to a depth of about 60 inches, is reddish brown, friable loam. In some places the surface layer is sandy loam. In some places, the sandy mantle is less than 20 inches thick and in some it is more than 40 inches thick. In places, the lower subsoil and the substratum are silt loam or sandy loam.

Included with this soil in mapping are small areas of Brevort and Menominee soils. The poorly drained and very poorly drained Brevort soils are in slightly lower areas of drainageways and depressions. The well drained Menominee soils are in slightly higher landscape positions. Also included are some areas that are very stony and small areas where dolomite bedrock is at a depth of 40 to 60 inches. These inclusions make up 5 to 10 percent of the unit.

In this Iosco soil permeability is rapid in the sandy mantle and moderately slow in the lower part of the subsoil and in the substratum. The available water capacity is moderate, and surface runoff is slow. Unless drained, the water table is at a depth of 1 to 3 feet during wet seasons. Depth of root penetration is limited by the water table during wet periods of the growing season. Organic matter content of the surface layer is moderate. The surface layer is very friable and is easily tilled.

Drained areas are used for crops and pasture. Undrained areas provide wildlife habitat, and some are used for unimproved pasture. Some areas are in woodland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage of this soil. Where drain tile are placed in the upper sandy portion of this soil, loose sand will enter the tile lines unless a suitable filter is used to cover the tile. Unless protected by plant cover, ditchbanks are eroded by flowing water. Vertical banks will cave and plug the ditch. Where drained and cultivated, this soil is subject to soil blowing. Soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, wind stripcropping, and field windbreaks.

Use of this soil as pasture or hayland is also effective in controlling soil blowing. Planting in early spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table, rapid permeability in the sandy surface layer and upper part of the subsoil, and moderately slow permeability in the lower part of the subsoil and in the substratum. Where the water table is at a depth of more than 2 feet these problems can be overcome by building a filtering mound of suitable material. This soil is poorly suited to dwellings with or without basements because of the seasonal high water table. This problem can be overcome by installing a subsurface drainage system with gravity outlet or other dependable outlet or by adding fill material to raise the site elevation and constructing the basement above the level of wetness. This soil is moderately suited to local roads and streets because of the seasonal high water table and the moderate potential for frost action. These problems can be overcome by lowering the seasonal high water table by installing a subsurface drainage system, using fill material to raise the roadbed above the wetness level, and increasing the subbase thickness using a coarse material such as sand or gravel.

This soil is in capability unit IIIw-6 and woodland suitability subclass 2o.

KaB—Kennan bouldery fine sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on convex ridgetops and side slopes. Most areas are irregular in shape and range from about 3 to 240 acres in size.

Typically, the surface layer is black, bouldery fine sandy loam about 2 inches thick. The upper part of the subsoil is dark yellowish brown, friable fine sandy loam about 3 inches thick. The next layer is mostly brown, friable fine sandy loam about 11 inches thick. The lower part of the subsoil extends to a depth greater than 60 inches. It is dark brown and brown, friable sandy loam and very friable loamy sand. Some small areas are eroded. In some places the surface layer is loam, sandy loam, or silt loam, and in some it has a few boulders and stones. In some places the substratum is stratified sand and gravel.

Included with this soil in mapping are small areas of Tilleda soils. The well drained Tilleda soils are similar to the Kennan soils in position on the landscape but have more silt and clay and less sand in the soil. Also included are small sloping areas of Kennan bouldery fine sandy loam. Small severely eroded areas are included where the soil has been cleared and cultivated. These inclusions make up about 5 to 10 percent of the unit.

Permeability is moderate in this Kennan soil. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate. The surface layer is very friable and can be easily tilled.

Some areas are used for crops and pasture, and some are in native woodland. Where the boulders and stones are removed, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture and hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Use of equipment for tree planting and harvesting is severely limited by the large number of boulders on or in the surface layer. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of the boulders and stones. This problem can be overcome by removing the boulders and stones by stone raking. This soil is moderately suited to dwellings with or without basements and local roads and streets because of the boulders and stones. This problem can be overcome by removing boulders and stones that interfere with construction. For dwellings without basements and local roads and streets, a coarse material such as sand or gravel can be used to cover the boulders and stones. This soil is also moderately suited to local roads and streets because of moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

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

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

Typically, the surface layer is very dark brown bouldery fine sandy loam about 3 inches thick. The upper part of the subsoil is dark brown, friable fine sandy loam about 7 inches thick. The next layer is grayish brown, friable fine sandy loam about 6 inches thick. The lower part of the subsoil extends to a depth greater than 60 inches. It is dark brown and brown, friable sandy loam in the upper part and reddish brown, very friable loamy sand in the lower part. Some small areas are eroded. In some places the surface layer is sandy loam, loam, or silt loam, and in some it has a few boulders and stones. In some places the substratum is stratified sand and gravel.

Included with this soil in mapping are small areas of Tilleda soils. The well drained Tilleda soils are similar to the Kennan soil in position on the landscape but have more silt and clay and less sand. Other inclusions are small, gently sloping and moderately steep areas of Kennan bouldery fine sandy loam. Also included are small severely eroded areas where the soil has been cleared and cultivated. These inclusions make up about 5 to 10 percent of the unit.

Permeability is moderate in this Kennan soil. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate. The surface layer is very friable and can be easily tilled.

Some areas are used as cropland and pasture, and some are in native woodland. Where the boulders and stones are removed, this soil is suited to corn and small grains and to grasses and legumes for hay and pasture. Where this soil is cultivated, there is a moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture or hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Use of equipment for tree planting and harvesting is severely limited by the large number of boulders on or in the surface layer. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of the boulders and stones and the slope. These problems can be overcome by removing the boulders and stones by stone raking and reducing the slope by cutting or cutting and adding fill material. The slope problem can also be overcome by installing the absorption field on the contour. This soil is moderately suited to dwellings with or without basements because of the boulders and stones and the slope. These problems can be overcome by removing boulders and stones that interfere with construction. For dwellings without basements, a coarse material such as sand or gravel can be added to raise the site above the boulders and stones. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil is moderately suited to local roads and streets because of the large stones, the slope, and the moderate potential for frost action. The problem of large stones can be overcome by removing stones that interfere with construction or by adding a coarse material such as sand or gravel to raise the roadbed above the boulders and stones. The problem of slope can be overcome by reducing the slope by cutting or cutting and adding fill material or by constructing roads on the contour. The frost problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

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

KaD—Kennan bouldery fine sandy loam, 12 to 20 percent slopes. This moderately steep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 85 acres in size.

Typically, the surface layer is very dark brown bouldery fine sandy loam about 2 inches thick. The upper part of the subsoil is dark brown, friable fine sandy loam about 5 inches thick. The next layer is brown, friable fine sandy loam about 4 inches thick. The lower part of the subsoil extends to a depth greater than 60 inches. It is brown, friable sandy loam and reddish brown, very friable loamy sand. Some small areas are eroded. In some places the surface layer is sandy loam, loam, or silt loam, and in some it has a few boulders and stones. In some places the substratum is stratified sand and gravel.

Included with this soil in mapping are small areas of Tilleda soils. The well drained Tilleda soils are similar to the Kennan soil in position on the landscape but have more silt and clay and less sand. Other inclusions are small, sloping and steep areas of Kennan bouldery fine sandy loam. Also included are small severely eroded areas where the soil has been cleared and cultivated. These inclusions make up about 5 to 10 percent of the unit.

Permeability is moderate in this Kennan soil. The available water capacity is moderate, and surface runoff from cultivated areas is rapid. Organic matter content of the surface layer is moderately low or moderate. The surface layer is very friable and is easily tilled.

Many areas are in native woodland, and some areas are used for crops and pasture. Where cleared of boulders and stones, this soil is suited to corn and small grains and to grasses and legumes for hay or pasture. Where this soil is used for cultivated crops, there is a severe hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture or hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Use of equipment for tree planting and harvesting is severely limited by the large number of boulders on or in the surface layer. Soil-related problems of forest management are associated with the steepness of slope; mortality of seedlings on hot, dry sites; and brush encroachment following harvest. Planting trees on the contour and careful location of skid roads during harvest will minimize erosion and improve equipment trafficability. Seedling mortality rates on south- and west-facing slopes can be reduced by careful planting and use of vigorous nursery stock. Vegetation that competes with planted seedlings or natural reproduction following harvest can be controlled through the use of suitable herbicides or can be removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material or by selecting a less sloping site. The soil is poorly suited to dwellings with or without basements and local roads and streets because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material; constructing buildings to conform to the existing slope by using piles, columns, or retaining walls; or by constructing local roads and streets on the contour.

This soil is in capability unit IVe-1 and woodland suitability subclass 1r.

KaE—Kennan bouldery fine sandy loam, 20 to 30 percent slopes. This steep, 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 grayish brown bouldery fine sandy loam about 3 inches thick. The subsurface layer is brown, very friable fine sandy loam about 4 inches thick. The subsoil is about 50 inches thick. It is mostly yellowish brown, very friable sandy loam in the upper part; brown and dark yellowish brown, friable sandy loam in the middle; and yellowish brown, very friable loamy sand in the lower part. The substratum, to a depth of about 60 inches, is brown, very friable sandy loam. Some small areas are eroded. In some places the surface layer is sandy loam, loam, or silt loam, and in some it has few boulders and stones. In some places the substratum is stratified sand and gravel.

Included with this soil in mapping are small moderately steep areas of Kennan bouldery fine sandy loam and some areas of this soil with slopes greater than 30 percent. Small severely eroded areas are included where the soil has been cleared and cultivated. Also included are some areas that have more silt and clay and less sand in the subsoil. These inclusions make up about 5 to 10 percent of the unit.

Permeability is moderate in this Kennan soil. The available water capacity is moderate, and surface runoff is very rapid. Organic matter content of the surface layer is moderately low or moderate.

Most areas are in native woodland, and some are used for hayland and pasture. This soil is generally unsuitable for cultivated crops because of the very severe hazard of erosion. It is suited to pasture and hayland. Where it is put to these uses, erosion and soil blowing are generally not problems. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is suited to growing trees. Use of equipment for tree planting and harvesting is severely limited by the large number of boulders on or in the surface layer. Soil-related problems of forest management are associated with steepness of slope; mortality of seedlings on hot, dry sites; and brush encroachment following harvest. Planting trees on the contour and careful location of skid roads during harvest will minimize erosion and improve equipment trafficability. Seedling mortality rates on south- and west-facing slopes can be reduced by careful planting and the use of vigorous nursery stock. Vegetation that competes with planted seedlings or natural reproduction following harvest can be controlled through the use of suitable herbicides or can be removed mechanically.

This soil is generally unsuited to septic tank absorption fields and dwellings with or without basements because of slope. This problem is difficult to overcome, and a different building site should be selected. This soil is poorly suited to local roads and streets because of slope. This problem can be overcome by shaping the site to a more suitable slope or by constructing local roads and streets on the contour.

This soil is in capability unit VIe-1 and woodland suitability subclass 1r.

LvB—Lorenzo Variant sandy loam, 1 to 6 percent slopes. This gently sloping, well drained soil is on flats and 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 7 inches thick. The subsoil is about 9 inches thick. It is reddish brown, very friable sandy loam in the upper part and reddish brown, very friable gravelly sandy loam in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand stratified with gravel. Some small areas are eroded. In some places the surface layer is loam, gravelly loam, or gravelly sandy loam.

Included with this soil in mapping are small areas of Boyer soils. The well drained Boyer soils are similar to the Lorenzo Variant soil in position on the landscape but are deeper over sand and gravel. Also included are small sloping areas and severely eroded areas of Lorenzo Variant soils. These inclusions make up 5 to 10 percent of the unit.

In this Lorenzo Variant soil permeability is moderate in the subsoil and very rapid in the substratum. The available water capacity is low, and surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying sand and gravel. Organic matter content of the surface layer is moderate or high. The surface layer is very friable and is easily tilled.

Most areas are used for crops and pasture. Some areas are in woodland. The soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields during most seasons are limited by low available water capacity. With irrigation and intensive management, this soil can produce better and more consistent yields. Where this soil is cultivated, there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production.

This soil is suited for pasture and hayland, but forage yields are generally somewhat limited unless this soil is fertilized and irrigated. Erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is suited to dwellings with or without basements and to local roads and streets. This soil is a probable source for sand and gravel.

This soil is in capability unit IIIe-12 and woodland suitability subclass 3o.

LvC—Lorenzo Variant sandy loam, 6 to 15 percent slopes. This sloping and moderately steep, well drained soil is on convex side slopes. Most areas are oblong in shape and range from about 3 to 50 acres in size.

Typically, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 9 inches thick. It is reddish brown, very friable sandy loam in the upper part and reddish brown, very friable gravelly sandy loam in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand stratified with gravel. Some small areas are eroded. In some places the surface layer is loam, gravelly loam, or gravelly sandy loam. In some places the solum is more than 20 inches thick.

Included with this soil in mapping are small gently sloping, moderately steep, and severely eroded areas of Lorenzo Variant soils. These inclusions make up 5 to 10 percent of the unit.

In this Lorenzo Variant soil permeability is moderate in the subsoil and very rapid in the substratum. The available water capacity is low, and surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying sand and gravel. Organic matter content of the surface layer is moderate or high. The surface layer is very friable and is easily tilled.

Most areas are used for crops and pasture. Some areas are in woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields during most seasons are limited by low available water capacity. With irrigation and intensive management, this soil can produce better and more consistent yields. Where this soil is cultivated there is a moderate hazard of erosion, and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production.

This soil is suited to pasture and hayland, but forage yields are generally somewhat limited unless this soil is fertilized and irrigated. Erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. The soil is moderately suited to dwellings with or without basements and to local roads and streets because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material or by selecting a less sloping site. Local roads and streets can also be constructed on the contour. This soil is a probable source for sand and gravel.

This soil is capability unit IVe-12 and woodland suitability subclass 3o.

Lx—Loxley mucky peat. This nearly level, very poorly drained soil in on low-lying flats and in depressions and drainageways. Most areas are irregular in shape, range from about 3 to 600 acres in size, and are subject to ponding.

Typically, the organic layer is more than 60 inches thick and is dark brown mucky peat in the upper part and dark reddish brown muck in the lower part. In some places there is up to 20 inches of sandy or loamy overwash.

Included with this soil in mapping are small areas of Cathro and Markey soils. The very poorly drained Cathro and Markey soils are similar to the Loxley soil in position on the landscape but have an organic layer less than 51 inches thick over mineral material. These inclusions make up 5 to 10 percent of the unit.

Permeability is moderately rapid in this Loxley soil. The available water capacity is very high, and surface runoff is very slow or ponded. Unless this soil is drained, the water table is at or near the surface throughout the year. This limits the depth of root penetration. Where this soil is drained the organic matter decomposes and subsidence will occur.

Most areas of this soil are undrained and support low-growing native vegetation. Some areas are in woodland. This soil is generally unsuited to cultivated crops and pasture because the growing season is limited by frost late in spring and early in fall. Drained areas are subject to burning, and cultivated areas are subject to soil blowing. Excessive lowering of the water table in this soil will increase subsidence.

Because of the high water table, periodic ponding, and low fertility, undrained areas of this soil are unsuitable for growing most forage species. Reed canarygrass is the only adapted species. Certain legumes such as red clover can be grown in drained areas, but the low strength of this soil restricts the use of machinery and limits livestock grazing.

This soil is not suited to woodland because it does not support trees of merchantable size and quality. Good land use may include management of woody cover for recreation use or wildlife habitat.

This soil is generally unsuited to septic tank absorption fields because of ponding. It is generally unsuited to dwellings with or without basements because it is subject to ponding and because it does not provide sufficient strength to support building foundations. This soil is generally unsuited to local roads and streets because of ponding and the high potential for frost action. These problems are difficult to overcome, and the simplest alternative is to select a different site on a more suitable soil.

This soil is in capability unit VIw-9, undrained. It is not assigned to a woodland suitability subclass.

MaA—Mahtomedi-Menahga loamy sands, 0 to 2 percent slopes. This unit consists of nearly level, excessively drained soils on flats. Most areas are irregular in shape and range from about 3 to 200 acres in size. Individual areas are 50 to 75 percent Mahtomedi soil and 20 to 45 percent Menahga soil. Areas of these two soils occupy similar landscape positions and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Mahtomedi soil has a dark brown, loamy sand surface layer about 6 inches thick. The subsoil is about 27 inches thick. It is brown, very friable loamy sand in the upper part and reddish brown, very friable gravelly loamy sand and gravelly sand in the lower part. The substratum, to a depth of about 60 inches, is brown and light brown, loose gravelly sand. Some small areas are eroded, and some are gently sloping. In some places this soil is more than 35 percent gravel in the surface layer, subsoil, or substratum.

Typically, the Menahga soil has a dark brown, loamy sand surface layer about 10 inches thick. The subsoil is about 26 inches thick. It is brown and strong brown, very friable sand in the upper part and strong brown, loose coarse sand in the lower part. The substratum, to a depth of about 60 inches, is brown loose sand. Some areas of this soil are eroded, and some are gently sloping.

Included with this unit in mapping are small areas of Au Gres and Cromwell soils. The somewhat poorly drained Au Gres soils are lower than the Mahtomedi and Menahga soils in position on the landscape and are in lower drainageways and depressions. The somewhat excessively drained Cromwell soils are similar to the Mahtomedi and Menahga soils in position on the landscape, but the surface layer and the upper part of the subsoil are sandy loam. Other inclusions are small areas where the surface layer is sand and small areas that are very stony. Also included are small areas where the water table is at a depth as shallow as 3 feet during wet seasons. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in this Mahtomedi and Menahga soil. The available water capacity of the surface layer is low or very low. Surface runoff is slow. Organic matter content of the surface layer is low or very low. The surface layer is friable and is easily tilled.

Many areas are used for crops and pasture, and some areas are in native woodland. Some areas have been planted to pine trees. These soils are suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields are generally limited by the low available water capacity. These soils are suited to sprinkler irrigation, however, and with irrigation they can produce better and more consistent yields. Erosion is generally not a problem, but these soils are subject to soil blowing. Soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, wind stripcropping, and field windbreaks. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability in these soils, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of these soils as pasture or hayland is also effective in controlling soil blowing, but forage yields are generally low unless these soils are fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on these soils. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

These soils are suited to growing trees. Seedling survival rates 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.

These soils readily accept the effluent from septic tank absorption fields but do not adequately filter it. This results in a danger of pollution of the ground water. These soils are suited to dwellings with or without basements and local roads and streets.

These soils are in capability unit IVs-4 and woodland suitability subclass 3s.

MaB—Mahtomedi-Menahga loamy sands, 2 to 6 percent slopes. This unit consists of gently sloping, excessively drained soils on convex side slopes. Most areas are irregular in shape and range from about 3 to 120 acres in size. Individual areas are 50 to 75 percent Mahtomedi soil and 20 to 45 percent Menahga soil. Areas of these two soils occupy similar landscape positions and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Mahtomedi soil has a dark brown, loamy sand surface layer about 6 inches thick. The subsoil is about 26 inches thick. It is brown, very friable loamy sand in the upper part and reddish brown, very friable gravelly loamy sand and gravelly sand in the lower part. The substratum, to a depth of about 60 inches, is brown and light brown, loose gravelly sand. Some small areas are eroded, and some are nearly level. In some places this soil is more than 35 percent gravel in the surface layer, subsoil, or substratum.

Typically, the Menahga soil has a dark brown, loamy sand surface layer about 6 inches thick. The subsoil is about 25 inches thick. It is brown, very friable sand in the upper part and strong brown, very friable sand in the lower part. The substratum, to a depth of about 60 inches, is light yellowish brown, loose sand in the upper part and brown, loose sand in the lower part. Some small areas are eroded, and some are nearly level.

Included with this unit in mapping are small areas of Au Gres and Cromwell soils. The somewhat poorly drained Au Gres soils are lower than the Mahtomedi and Menahga soils in position on the landscape and are in drainageways and depressions. The somewhat excessively drained Cromwell soils are similar to the Mahtomedi and Menahga soils in position on the landscape, but the surface layer and the upper part of the subsoil are sandy loam. Other inclusions are small sloping areas and severely eroded areas of Mahtomedi-Menahga loamy sands and some areas where the surface layer is sand. Also included are small areas that are very stony and areas where the water table is at a depth as shallow as 3 feet during wet seasons. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in these Mahtomedi and Menahga soils. The available water capacity is low or very low. Surface runoff from cultivated areas is medium. Organic matter content of the surface layer is low or very low. The surface layer is friable and can be easily tilled.

Many areas are used for crops and pasture. Some areas are in native woodland. Some areas have been planted to pine trees. These soils are suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields are generally limited by the low available water capacity. These soils are suited to sprinkler irrigation, however, and with irrigation they can produce better and more consistent yields. Where cultivated, there is a slight hazard of erosion and these soils are subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability in these soils, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of these soils for pasture or hayland is also effective in controlling erosion and soil blowing. Yields are generally low unless these soils are fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on these soils. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

These soils are suited to growing trees. Seedling survival rates 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.

These soils readily accept the effluent from septic tank absorption fields but do not adequately filter it. This results in a danger of pollution of the ground water. These soils are suited to dwellings with or without basements and local roads and streets.

These soils are in capability unit IVs-4 and woodland suitability subclass 3s.

MaC—Mahtomedi-Menahga loamy sands, 6 to 12 percent slopes. This unit consists of excessively drained soils on convex side slopes. Most areas are irregular in shape and range from about 3 to 40 acres in size. Individual areas are 50 to 75 percent Mahtomedi soil and 20 to 45 percent Menahga soil. Areas of these two soils occupy similar landscape positions and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Mahtomedi soil has a very dark brown, loamy sand surface layer about 4 inches thick. The subsoil is about 24 inches thick. It is brown, very friable loamy sand in the upper part and reddish brown, very friable gravelly loamy sand and gravelly sand in the lower part. The substratum, to a depth of about 60 inches, is brown and light brown, loose gravelly sand. Some small areas of this soil are eroded. In some places this soil is more than 35 percent gravel in the surface layer, subsoil, or substratum.

Typically, the Menahga soil has a very dark brown, loamy sand surface layer about 4 inches thick. The subsoil is strong brown, loose sand about 19 inches thick. The substratum, to a depth of about 60 inches, is light yellowish brown, loose sand. Some small areas are eroded.

Included with this unit in mapping are small areas of Cromwell soils. The somewhat excessively drained Cromwell soils are similar to the Mahtomedi and Menahga soils in position on the landscape, but the surface layer and upper part of the subsoil are sandy loam. Other inclusions are small gently sloping, moderately steep, and severely eroded areas of Mahtomedi-Menahga loamy sands. Also included are small areas where the surface layer is sand and some areas that are very stony. These inclusions make up 5 to 10 percent of the unit.

Permeability is rapid in these Mahtomedi and Menahga soils. The available water capacity is low or very low. Surface runoff from cultivated areas is medium. Organic matter content of the surface layer is low or very low. The surface layer is very friable and can be easily tilled.

Most areas are used as woodland. Some areas are in pasture or cropland. These soils are generally unsuitable for crop production. Crop yields are limited during most seasons by the low available water capacity. These soils are suited to sprinkler irrigation, however, and with irrigation they are suited to corn and small grains and to legumes and grasses for hay and pasture. Where these soils are cultivated, there is a moderate hazard of erosion and they are subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability in these soils, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of these soils for pasture or hayland is also effective in controlling erosion and soil blowing. Forage yields are generally low unless these soils are fertilized and irrigated. Planting in early spring, before the surface layer has a chance to dry, is best on these soils. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

These soils are suited to growing trees. Seedling survival rates 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.

These soils readily accept the effluent from septic tank absorption fields but do not adequately filter it. This results in a danger of pollution of the ground water. These soils are moderately suited to dwellings with or without basements and to local roads and streets because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material or constructing roads on the contour.

These soils are in capability unit VIs-4 and woodland suitability subclass 3s.

MaD—Mahtomedi-Menahga loamy sands, 12 to 30 percent slopes. This unit consists of moderately steep and steep, excessively drained soils on convex side slopes. Most areas are irregular in shape and range from about 3 to 100 acres in size. Individual areas are 50 to

75 percent Mahtomedi soil and 20 to 45 percent Menahga soil. Areas of these two soils occupy similar landscape positions and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Mahtomedi soil has a very dark brown, loamy sand surface layer about 3 inches thick. The subsoil is about 23 inches thick. It is brown, very friable loamy sand in the upper part and reddish brown, very friable gravelly loamy sand and gravelly sand in the lower part. The substratum, to a depth of about 60 inches, is brown and light brown, loose gravelly sand. Some small areas are eroded. Also, in some places this soil is more than 35 percent gravel in the solum or substratum and in places it has slopes greater than 30 percent.

Typically, the Menahga soil has a very dark brown, loamy sand surface layer about 3 inches thick. The subsoil is strong brown, loose sand about 18 inches thick. The substratum, to a depth of about 60 inches, is light yellowish brown, loose sand. Some small areas are eroded. In some places this soil has slopes greater than 30 percent.

Included with this unit in mapping are small areas of Cromwell soils. The somewhat excessively drained Cromwell soils are similar to the Mahtomedi and Menahga soils in position on the landscape, but the surface layer and upper part of the subsoil are sandy loam. Other inclusions are some small sloping areas and severely eroded areas of Mahtomedi-Menagha loamy sands. Also included are small areas where the surface layer is sand and small areas that are very stony. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in this Mahtomedi and Menahga soil. The available water capacity is low or very low. Surface runoff from cultivated areas is rapid. Organic matter content of the surface layer is low or very low.

Most areas are in native woodland. A few small areas are used for crops and pasture. Because of the low available water capacity, severe and very severe hazard of erosion, and soil blowing hazard, these soils are unsuitable for cultivated crops.

Use of these soils as pasture or hayland is effective in controlling erosion and soil blowing, but forage yields are generally low because of the low or very low available water capacity. Planting early in spring, before the surface layer has a chance to dry, is best on these soils. Later plantings are less likely to survive. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

These soils are suited to growing trees. Erosion may be controlled by planting trees on the contour and by careful location of skid roads during harvest. Survival rates of planted trees can be increased by careful planting of vigorous nursery stock. Vegetation that competes with natural regeneration following harvest can be controlled by the use of suitable herbicides or mechanical removal.

These soils are poorly suited to septic tank absorption fields because of the slope. Where the slope is less than about 20 percent, this problem can be overcome by cutting or cutting and adding fill material to get a suitable slope. These soils readily accept the effluent from septic tank absorption fields but do not adequately filter it. This results in a danger of pollution of the ground water. These soils are poorly suited to dwellings with or without basements because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. Where the slope is greater than about 20 percent, the slope problem is difficult to overcome and a different building site should be selected. These soils are poorly suited to local roads and streets because of slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material, or by constructing roads on the contour.

These soils are in capability unit VIIs-4 and woodland suitability subclass 3s.

McA—Manawa silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on low-lying flats and in drainageways and depressions. Some areas are subject to flooding. Most areas are irregular in shape and range from about 3 to 50 acres in size.

Typically, the surface layer is very dark brown silt loam about 9 inches thick. The subsoil is about 23 inches thick. It is dark reddish brown, mottled, firm silty clay loam in the upper part and reddish brown, mottled, firm silty clay and silty clay loam in the lower part. The substratum, to a depth of about 60 inches, is reddish brown, mottled, firm silty clay loam. In some places the surface layer is loam or sandy loam. In some places the substratum contains thin layers of silt loam.

Included with this soil in mapping are small areas of Briggsville soils. The well drained Briggsville soils are slightly higher than the Manawa soil in position on the landscape. Also included are small areas where the water table is at or near the surface. These inclusions make up 5 to 10 percent of the unit.

Permeability is slow in this Manawa soil. The available water capacity is high, and surface runoff is slow. Unless this soil is drained, the seasonal high water table is at a depth of 1 to 3 feet during wet periods. Depth of root penetration is limited by the water table during wet periods of the growing season. Organic matter content of the surface layer is high. The surface layer is friable and is easily tilled, but it has a tendency to crust after heavy rains.

Drained areas are used for crops and pasture. Undrained areas provide wildlife habitat, and some are used for unimproved pasture. Some areas are in native woodland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage of this soil. Unless protected by plant cover, ditchbanks are eroded by flowing water. Vertical banks will cave and plug the ditch. Regular additions of organic matter help to maintain fertility and good tilth.

Where drained, this soil is suited to pasture and hayland. Overgrazing, however, leads to a loss of plant cover and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction and results in poor tilth and reduced water infiltration. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is generally unsuited to septic tank absorption fields because of the seasonal high water table, slow permeability, and flooding. This soil is poorly suited to dwellings with or without basements because of the seasonal high water table and flooding. The flooding problem is especially difficult to overcome, and a different building site should be selected. This soil is poorly suited to local roads and streets because of the high potential for frost action, insufficient strength to support vehicular traffic, and flooding. The frost problem can be overcome with subsurface drainage to lower the seasonal high water table and by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel. The low strength problem can be overcome by strengthening the soil with lime, by covering or replacing it with a coarse base material such as sand or gravel, or by increasing the thickness of pavement, base, or subbase material. The flooding problem can be overcome by using fill material to construct roads above the flooding level and by constructing stable overflow sections by having dips in the road covered with a strong concrete cover and riprap on the sides of the road. Larger bridges and culverts will permit floodwater to drain away.

This soil is in capability unit IIw-2 and woodland suitability subclass 2c.

Mk—Markey and Cathro mucks. These nearly level, very poorly drained soils are on low-lying flats and in drainageways and depressions. Most areas are irregular in shape, range from about 3 to 600 acres in size, and are subject to ponding. Some areas are 60 to 90 percent Markey soil and 0 to 30 percent Cathro soil. Other areas are 60 to 90 percent Cathro soil and 0 to 30 percent Markey soil. Some areas are 35 to 45 percent each soil. The Markey and Cathro soils are similar enough in composition and behavior that mapping them separately was not important for the objectives of this survey.

In the Markey soil, the organic layer typically is black muck about 28 inches thick. The substratum, to a depth of about 60 inches, is dark grayish brown, loose sand. Some areas have up to 16 inches of sandy or loamy overwash. In some areas there are sandy or loamy layers in the organic layer, and in some there are loamy layers in the underlying sand.

In the Cathro soil, the organic layer typically is black and very dark brown muck about 26 inches thick. The substratum, to a depth of about 60 inches, is grayish brown, friable silt loam. Some small areas have slopes slightly greater than 2 percent, and some small areas have up to 16 inches of loamy overwash.

Included with this unit in mapping are small areas of Angelica, Bach, Cormant, Minocqua, and Seelyeville soils. The poorly drained and very poorly drained Angelica, Bach, Cormant, and Minocqua soils are similar to the Markey and Cathro soils in position on the landscape but do not have the 16- to 50-inch thick organic layer. The very poorly drained Seelyeville soils, which are in similar landscape positions, have an organic layer more than 51 inches thick. Also included are small areas that are underlain by marl. These inclusions make up 5 to 10 percent of the unit.

In the Markey soil, permeability is moderately rapid in the organic layer and rapid in the sand substratum. In the Cathro soil, permeability is moderately rapid in the organic layers and moderate in the substratum. The available water capacity is very high in these soils. Surface runoff is very slow or ponded. Unless these soils are drained, the water table is at or near the surface throughout the year. Depth of root penetration is limited by the water table or, in drained areas, by the underlying sand. Where these soils are drained, the organic layer decomposes and subsidence will occur.

Most areas of these soils are undrained and are in woodland. These areas are generally unsuited to cultivated crops and pasture because the growing season is limited by frost late in spring and early in fall. Drained areas of these soils are subject to burning, and cultivated areas are subject to soil blowing. Excessive lowering of the water table in these soils will increase subsidence.

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

These soils are suited to growing trees. Soil wetness during tree planting season limits reforestation to natural regeneration. Because of wetness, the use of heavy equipment for harvesting is confined to when the soil is frozen. Windthrow of trees left after harvest can be reduced by clear-cut or group-selection methods of harvest. Competing vegetation, which hinders natural regeneration, can be controlled by the use of suitable herbicides or removed mechanically.

These soils are generally unsuited to septic tank absorption fields because of the high water table. These soils are generally unsuited to dwellings with or without basements because they are subject to ponding and because they lack sufficient strength to support building foundations. These soils are generally unsuited to local roads and streets because of ponding and the high potential for frost action. These problems are difficult to overcome, and perhaps the simplest alternative is to select a different site on a more suitable soil.

These soils are in capability unit and VIw-7, undrained. The Markey soil is in woodland suitability subclass 2w; the Cathro soil is in 3w.

MnA—Menahga loamy sand, 0 to 2 percent slopes. This nearly level, excessively drained soil is on flats. Most areas are irregular in shape and range from about 3 to 1,000 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsoil is about 26 inches thick. It is brown and strong brown, very friable sand in the upper part and strong brown, loose coarse sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand. Some areas of this soil are eroded, and some are gently sloping. In some places the surface layer is loamy fine sand. In some places this soil is more than 15 percent pebbles by volume in the surface layer, subsoil, or substratum.

Included with this soil in mapping are small areas of Au Gres, Croswell, and Shawano soils. The somewhat poorly drained Au Gres soils are in lower areas in drainageways and depressions. The moderately well drained Croswell soils are in slightly lower landscape positions than are the Menahga soils. The excessively drained Shawano soils are similar to the Menahga soil in position on the landscape but are dominantly fine sand. Also included are some small areas where the surface layer is sand and some areas that are very stony. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in this Menahga soil. The available water capacity is low, and surface runoff is slow. Organic matter content of the surface layer is low or very low. The surface layer is very friable and can be easily tilled.

Many areas are used as cropland and pasture. Some areas are in native woodland, and some have been planted to pine trees. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields are generally limited by the low available water capacity. This soil is suited to sprinkler irrigation, however, and with irrigation it can produce better and more consistent yields. Erosion is generally not a problem, but this soil is subject to soil blowing. Soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, wind stripcropping, and field windbreaks. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability in this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of this soil for pasture or hayland is also effective in controlling soil blowing. Yields are generally low unless this soil is fertilized and irrigated. Planting in early spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to growing trees. Seedling survival rates 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 accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is suited to dwellings with or without basements and to local roads and streets.

This soil is in capability unit IVs-4 and woodland suitability subclass 3s.

MnB—Menahga loamy sand, 2 to 6 percent slopes. This gently sloping, excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 1,300 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 10 inches thick. The subsoil is about 15 inches thick. It is dark brown, very friable sand in the upper part and strong brown, very friable sand in the lower part. The substratum, to a depth of about 60 inches, is light yellowish brown, loose sand in the upper part and brown, loose sand in the lower part. Some small areas are eroded, and some are nearly level. In some places the surface layer is loamy fine sand. In some places this soil is more than 15 percent pebbles by volume in the surface layer, subsoil, or substratum.

Included with this soil in mapping are small areas of Au Gres, Croswell, and Shawano soils. The somewhat poorly drained Au Gres soils are in lower areas in drainageways and depressions. The moderately well drained Croswell soils are in slightly lower landscape positions than are the Menahga soils. The excessively drained Shawano soils are similar to the Menahga soil in position on the landscape but are dominantly fine sand. Other inclusions are small sloping areas and severely eroded areas of Menahga loamy sand. Also included are small areas where the surface layer is sand, some areas that are very stony, and small areas where granite bedrock is at a depth of 40 to 60 inches. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in this Menahga soil. The available water capacity is low, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is low or very low. The surface layer is very friable and can be easily tilled.

Many areas are used as cropland and pasture. Some areas are in native woodland, and some have been planted to pine trees. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields are generally limited by the low available water capacity. This soil is suited to sprinkler irrigation, however, and with irrigation it can produce better and more consistent yields. Where cultivated, there is a slight hazard of erosion and this soil is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability in this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of this soil as pasture or hayland is also effective in controlling soil blowing. Yields are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

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

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is suited to dwellings with or without basements and local roads and streets.

This soil is in capability unit IVs-4 and woodland suitability subclass 3s.

MnC—Menahga loamy sand, 6 to 12 percent slopes. This sloping, 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 loamy sand about 4 inches thick. The subsoil is strong brown, loose sand about 19 inches thick. The substratum, to a depth of about 60 inches, is light yellowish brown, loose sand. Some small areas are eroded. In some places this soil is more than 15 percent gravel by volume in the surface layer, subsoil, or substratum.

Included with this soil in mapping are small areas of Shawano soils. The excessively drained Shawano soils are similar to the Menahga soil in position on the landscape but are dominantly fine sand. Other inclusions are small gently sloping, moderately steep, or severely eroded areas of Menahga loamy sand. Also included are some areas where the surface layer is sand, some areas that are very stony, and some areas where granite bedrock is at a depth of 40 to 60 inches. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in this Menahga soil. The available water capacity is low, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is low or very low. The surface layer is very friable and can be easily tilled.

Some areas are used as woodland, and some areas are used for crops and pasture. This soil is generally unsuitable for crop production. Crop yields during most seasons are limited by the low available water capacity. This soil is, however, suited to sprinkler irrigation. If irrigated, it is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability of this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of this soil as pasture or hayland is also effective in controlling erosion and soil blowing. Forage yields are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

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

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is moderately suited to dwellings with or without basements and to local roads and streets because of the slope. This problem can be overcome for all of these uses by reducing the slope by cutting or cutting and adding fill material. Local roads and streets can be constructed on the contour.

This soil is in capability unit VIs-4 and woodland suitability subclass 3s.

MnD—Menahga loamy sand, 12 to 30 percent slopes. This moderately steep and steep, 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 loamy sand about 3 inches thick. The subsoil is strong brown, loose sand about 18 inches thick. The substratum, to a depth of about 60 inches, is light yellowish brown, loose sand. Some small areas are eroded. In some places this soil is more than 15 percent gravel by volume in the surface layer, subsoil, or substratum.

Included with this soil in mapping are small areas of Shawano soils. The excessively drained Shawano soils are similar to the Menahga soil in position on the landscape but are dominantly fine sand. Other inclusions are small sloping areas and severely eroded areas of Menahga loamy sand. Also included are some areas where the surface layer is sand and some areas that are very stony. These inclusions make up 5 to 10 percent of the unit.

Permeability is rapid in this Menahga soil. The available water capacity is low, and surface runoff from cultivated areas is rapid. Organic matter content of the surface layer is low or very low.

Most areas are in native woodland, and some areas have been planted to pine trees. A few small areas are used for crops and pasture. Because of the low available water capacity, the severe and very severe hazard of erosion, and the soil blowing hazard, this soil is unsuitable for cultivated crops.

Use of this soil as pasture or hayland is effective in controlling erosion and soil blowing, but forage yields are generally low because of the low available water capacity. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to trees. Erosion can be controlled by planting trees on the contour and careful location of skid roads during harvest. Survival rates of planted trees can be increased by careful planting of vigorous nursery stock. Vegetation that competes with natural regeneration following harvest can be controlled by the use of suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields because of the slope. Where the slope is less than about 20 percent, this problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is poorly suited to dwellings with or without basements because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. Where the slope is greater than about 20 percent, the slope problem is difficult to overcome and a different building site should be selected. This soil is poorly suited to local roads and streets because of slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material or by constructing roads on the contour.

This soil is in capability unit VIIs-4 and woodland suitability subclass 3s.

MsB—Menominee loamy sand, 1 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on flats and convex side slopes. Most areas are irregular in shape and range from about 3 to 340 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The upper part of the subsoil is about 18 inches thick. It is dark brown and brown, very friable loamy sand and sand. The next layer is brown, very friable fine sandy loam about 4 inches thick. The lower part of the subsoil is about 16 inches thick. It is mostly reddish brown, friable clay loam. The substratum, to a depth of about 60 inches, is reddish brown, friable loam. In some places the surface layer is sandy loam or loamy fine sand. In some places the upper sandy layer is less than 20 inches thick and in other places it is more than 40 inches thick. Some small areas have slopes less than 1 percent.

Included with this soil in mapping are small areas of Iosco, Menahga, Onaway, Shawano, and Tilleda soils. The excessively drained Menahga and Shawano soils are similar to the Menominee soil in position on the landscape but are sandy throughout. The well drained Onaway and Tilleda soils are in similar landscape positions but do not have the 20- to 40-inch thick sandy mantle. The somewhat poorly drained Iosco soils are in lower landscape positions in drainageways and depressions. Other inclusions are small sloping areas and some areas that are very stony. Also included are small areas where the water table is at depths as shallow as 3 feet during wet seasons and areas where the substratum is silty clay loam, silty clay, or clay. These inclusions make up 10 to 15 percent of the unit.

In this Menominee soil the permeability is rapid in the sandy upper part of the profile and moderate in the loamy lower part. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is low. The surface layer is very friable and can be easily tilled.

Most areas are used for crops or pasture. Some areas remain in native woodland. This soil is suited to corn and small grains and to grasses and legumes for hay and pasture. It is suited to sprinkler irrigation, and if irrigated it can produce better and more consistent yields. Where this soil is cultivated, there is a slight hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production.

The use of this soil as pasture or hayland is also effective in controlling soil blowing. Forage yields are generally somewhat limited unless this soil is irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing will keep the vegetation in good condition.

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

This soil is suited to septic tank absorption fields. They will function satisfactorily in this soil, but in the sandy layers there is a danger of lateral movement of the effluent. This problem can be overcome by placing the fields in the loamy layers. This soil is suited to dwellings with or without basements. This soil is moderately suited to local roads and streets because of the moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIIe-4 and woodland suitability subclass 1s.

MsC—Menominee loamy sand, 6 to 12 percent slopes. This sloping, well drained soil is on convex side slopes. Most areas are irregular in shape and range from 3 to 70 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 8 inches thick. The upper part of the subsoil is about 16 inches thick. It is dark brown and brown, very friable loamy sand and sand. The next layer is brown, very friable fine sandy loam about 4 inches thick. The lower part of the subsoil is about 16 inches thick. It is mostly reddish brown, friable clay loam. The substratum, to a depth of about 60 inches, is reddish brown, friable loam. In some places the surface layer is sandy loam. In some places the sandy mantle is less than 20 inches thick, and in some other places it is more than 40 inches thick. In some places there are no free carbonates within a depth of 60 inches.

Included with this soil in mapping are small areas of Menahga, Onaway, Shawano, and Tilleda soils. The excessively drained Menahga and Shawano soils are similar to the Menominee soil in position on the landscape but are sandy throughout. The well drained Onaway and Tilleda soils are in similar landscape positions but do not have a 20- to 40-inch-thick sandy mantle. Other inclusions are small gently sloping areas and moderately steep areas of Menominee loamy sand. Also included are small severely eroded areas, some areas that are very stony, and areas where the substratum is silty clay loam, silty clay, or clay. These inclusions make up 10 to 15 percent of the unit.

In this Menominee soil the permeability is rapid in the sandy upper layers and moderate in the loamy lower layers. The available water capacity is moderate. Surface runoff from cultivated areas is medium. Organic matter content of the surface layer is low. The surface layer is very friable and easily tilled.

Most areas of this soil are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to grasses and legumes for hay and pasture. It is suited to sprinkler irrigation, and if irrigated it can produce better and more consistent yields. Where this soil is cultivated, there is a moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production.

Use of this soil as pasture or hayland is also effective in controlling erosion and soil blowing. Forage yields are generally somewhat limited unless this soil is irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to trees. Seedling survival rates 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 moderately suited to septic tank absorption fields because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. Septic tank absorption fields will function satisfactorily in this soil, but there is a danger of lateral movement of the effluent in the sandy upper part of the profile. This problem can be overcome by placing the fields in the loamy layers. This soil is moderately suited to dwellings with or without basements because of the slope. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil is moderately suited to local roads and streets because of the slope and moderate potential for frost action. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material, or by constructing roads on the contour. The frost problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IVe-4 and woodland suitability subclass 1s.

MsD—Menominee loamy sand, 12 to 20 percent slopes. This moderately steep, 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 dark grayish brown loamy sand about 4 inches thick. The upper part of the subsoil is about 17 inches thick. It is dark brown and brown, very friable loamy sand and sand. The next layer is brown, very friable fine sandy loam about 4 inches thick. The lower part of the subsoil is about 14 inches thick. It is reddish brown, friable clay loam. The substratum, to a depth of about 60 inches, is reddish brown, friable loam. In some places the surface layer is loamy fine 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. The excessively drained Menahga and Shawano soils are similar to the Menominee soil in position on the landscape but are sandy throughout. The well drained Onaway and Tilleda soils are in similar landscape positions, but do not have a 20- to 40-inch-thick sandy mantle. Other inclusions are small sloping areas and severely eroded areas of Menominee loamy sand and small areas with slopes greater than 20 percent. Also included are some areas that are very stony. These inclusions make up 10 to 15 percent of the unit.

In this Menominee soil the permeability is rapid in the sandy upper layers and moderate in the loamy lower layers. The available water capacity is moderate. Surface runoff from cultivated areas is rapid. Organic matter content of the surface layer is low. The surface layer is very friable and easily tilled.

Most areas of this soil are in pasture or woodland. Some areas are in crops. This soil is generally unsuited to growing cultivated crops but is suited to growing legumes and grasses for hay and pasture. If this soil is cultivated, there is a severe hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Returning crop residue, fertilization, and the regular addition of other organic matter improve fertility.

Use of this soil as pasture or hayland is also effective in controlling erosion and soil blowing. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to trees. Erosion can be controlled by planting trees on the contour and careful location of skid roads during harvest. Survival rates of planted trees can be increased by careful planting of vigorous nursery stock. Vegetation that competes with natural regeneration following harvest can be controlled by the use of suitable herbicides or mechanical removal.

This soil is poorly suited to septic tank absorption fields because of slope. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material. Septic tank absorption fields will function satisfactorily on suitable slopes, but there is a danger of lateral movement of the effluent in the sandy layers. This problem can be overcome by placing the fields in the loamy layers. This soil is poorly suited to dwellings with or without basements and to local roads and streets because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. Local roads and streets can also be constructed on the contour.

This soil is in capability unit VIe-4 and woodland suitability subclass 1s.

Mu—Minocqua silt loam. This nearly level, poorly drained and very poorly drained soil is on low-lying flats, in depressions, and in drainageways. Most areas are long and narrow or irregular in shape, range from about 3 to 600 acres in size, and are subject to flooding or ponding, or both.

Typically, the surface layer is very dark gray silt loam about 5 inches thick. The subsoil is about 29 inches thick. It is dark gray, gray, and grayish brown, mottled, friable silt loam and loam. The substratum, to a depth of about 60 inches, is brown and pale brown, mottled, loose loamy sand. In some places the surface layer is sandy loam, fine sandy loam, or loam. In some places the loamy mantle is less than 20 inches thick over the underlying sand or loamy sand. In some places the sandy substratum contains loamy or gravelly strata and in some places it contains free carbonates.

Included with this soil in mapping are small areas of Cathro, Markey, and Oesterle soils. The very poorly drained Markey and Cathro soils are in slightly lower areas than are the Minocqua soil and have a 16- to 51-inch-thick organic layer. The somewhat poorly drained Oesterle soils occupy slightly higher landscape positions. Also included are many areas that are very stony and some areas where granite bedrock is at a depth of 40 to 60 inches. These inclusions make up 10 to 15 percent of the unit.

In this Minocqua soil the permeability is moderate in the subsoil and rapid in the substratum. The available water capacity is moderate. Surface runoff is very slow or ponded. Unless this soil is drained, the water table is at or near the surface most of the year. Depth of root penetration is limited by the water table or, in drained areas, by the sandy deposits. Organic matter content of the surface layer is high or very high. The surface layer is friable and can be easily tilled.

Most areas of this soil are undrained and are in woodland. These areas are generally unsuited to crops. Undrained areas provide wildlife habitat, and some are used for unimproved pasture. A few areas have been drained and are used for corn and small grains and for legumes and grasses for hay and pasture.

Because of the high water table and periodic ponding, undrained areas of this soil are unsuitable for most forage species and are restricted to species such as reed canarygrass. Drained areas are suited to certain legumes and grasses. Overgrazing leads to loss of plant cover and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction and results in poor tilth and reduced water infiltration. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Soil wetness generally requires preparing ridges and planting by hand or machine if natural regeneration is unreliable. Use of vigorous nursery stock will reduce the mortality rate. Harvest is frequently limited to when the soil is frozen. Harvest by clear-cut or area-selection methods will help reduce windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by the use of suitable herbicides or mechanical removal.

This soil is generally unsuited to septic tank absorption fields because of flooding and ponding, and rapid permeability in the substratum. This soil is generally unsuited to dwellings with or without basements because of flooding and ponding. These problems are difficult to overcome for these uses and a different site on a more suitable soil should be selected. This soil is poorly suited to local roads and streets because of flooding and ponding and the high potential for frost action. These problems can be overcome by removing surface water through suitable outlets with ditches and culverts. Installing culverts can also help prevent road damage by equalizing the water level on both sides of the road. Larger bridges or culverts will permit floodwater to drain away more rapidly. Fill material can be used to construct roads above the flooding level. Damage from frost can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit VIw-6, undrained. It is in woodland suitability subclass 3w.

ObA—Oesterle loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on low-lying flats, in drainageways and depressions, and on concave foot slopes. Some areas are subject to flooding. Most areas are irregular in shape and range from about 3 to 120 acres in size.

Typically, the surface layer is dark brown loam about 9 inches thick. The subsurface layer is mostly brown, mottled, friable loam about 6 inches thick. The subsoil is about 12 inches thick. It is mostly dark brown, mottled, friable loam in the upper part and reddish brown, mottled, very friable gravelly loamy sand in the lower part. The substratum, to a depth of 60 inches, is strong brown, mottled, loose gravelly sand in the upper part; light yellowish brown, mottled, loose sand in the middle part; and yellowish brown, mottled, very friable stratified loamy sand and loamy fine sand in the lower part. In some places the surface layer is sandy loam or loamy sand, and in some the dark surface layer is more than 9 inches thick. In some places the loamy mantle is less than 20 inches thick, and in others it is more than 36 inches thick. In some places the substratum is calcareous.

Included with this unit in mapping are small areas of Au Gres, Minocqua, Rosholt, and Scott Lake soils. The somewhat poorly drained Au Gres soils are similar to the Oesterle soil in position on the landscape but are sandy throughout. The well drained Rosholt soils and the moderately well drained Scott Lake soils occupy higher positions in the landscape. The poorly drained and very poorly drained Minocqua soils occupy lower landscape positions in drainageways and depressions. Also included are many areas of Oesterle soils that are very stony and some small areas where granite bedrock is at a depth of 40 to 60 inches. These inclusions make up about 10 to 15 percent of the unit.

In this Oesterle soil the permeability is moderate in the subsoil and rapid in the substratum. The available water capacity is moderate, and surface runoff is slow. Unless this soil is drained, the water table is at a depth of 1 to 3 feet during wet seasons. Depth of root penetration is limited by the water table during wet periods of the growing season or, in drained areas, by the sandy deposits. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled.

Drained areas are used for crops and pasture. Undrained areas provide wildlife habitat, and some are used for unimproved pasture. Many areas are in woodland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage. Where tile drainage is used, loose sand will enter the tile lines unless the tile are covered with a suitable filter. Unless they are protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks will cave and plug the ditch. Regular additions of organic matter help to maintain fertility and good tilth.

Where drained, this soil is suited to pasture and hayland. Overgrazing leads to a loss of plant cover and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction and results in poor tilth and reduced water infiltration. Fertilization, renovation, and controlled grazing help to keep the soils and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table, flooding, and rapid permeability in the substratum. Where the water table is at a depth of more than 2 feet these problems can be overcome by building a filtering mound of suitable material. Dikes and diversions will protect the site from flooding. This soil is poorly suited to dwellings with or without basements because of the seasonal high water table and flooding. These problems can be overcome by diverting water away from the dwelling with a diversion or dike or by raising the site elevation by adding fill material. A subsurface drainage system with a gravity or other dependable outlet will remove water away from the foundation. This soil is poorly suited to local roads and streets because of the high potential for frost action. The frost problem can be overcome by subsurface drainage of the roadbed and by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIw-5 and woodland suitability subclass 3o.

OeB—Onaway fine sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 2,000 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsurface layer is mostly brown, friable fine sandy loam about 6 inches thick. The subsoil is about 13 inches thick. It is dark reddish brown, firm loam in the upper part and dark reddish brown, friable loam in the lower part. The substratum, to a depth of about 60 inches, is dark brown, friable sandy loam. Some areas have slopes of less than 2 percent, and some are eroded. In some places the surface layer is silt loam or loam, and in some the depth to free carbonates is more than 30 inches. In some areas the substratum is stratified silt and very fine sand.

Included with this soil in mapping are small areas of Fairport, Menominee, and Solona soils. The well drained Fairport soils are similar to the Onaway soil in position on the landscape but have dolomite bedrock at depths of 20 to 40 inches. The well drained Menominee soils are in similar landscape positions but have a 20- to 40-inch-thick sandy mantle. The somewhat poorly drained Solona soils are in slightly lower landscape positions in drainageways and depressions. Other inclusions are small sloping areas and severely eroded areas of Onaway fine sandy loam and small areas where the water table is at depths as shallow as 3 feet. Also included are small areas where dolomite bedrock is at a depth of 40 to 60 inches. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderate in this Onaway soil. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled.

Many areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture or hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of the moderate permeability. This problem can be overcome by building a filtering mound of suitable material or by enlarging the absorption field. This soil is suited to dwellings with or without basements. It is moderately suited to local roads and streets because of the moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIe-1 and woodland suitability subclass 2o.

OeC2—Onaway fine sandy loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on 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 fine sandy loam about 8 inches thick. In most cultivated areas, plowing has mixed some reddish brown, loam subsoil material into the surface layer. The subsoil is about 16 inches thick. It is mostly reddish brown, firm clay loam. The substratum, to a depth of about 60 inches, is reddish brown, friable loam. Some areas are uneroded. In some places the surface layer is silt loam or loam, and in some the depth to free carbonates is less than 15 inches. Also, in some places the substratum is stratified silt and fine sand.

Included with this soil in mapping are small gently sloping, moderately steep, and severely eroded areas of Onaway fine sandy loam. Also included are small areas of Fairport and Menominee soils. The well drained Fairport soils are similar to the Onaway soil in position on the landscape but have dolomite bedrock at depths of 20 to 40 inches. The well drained Menominee soils are in similar landscape positions but have a 20- to 40-inch-thick sandy mantle. Other inclusions are small gently sloping, moderately steep, and severely eroded areas of Onaway fine sandy loam. Also included are small areas that have more sand and less clay in the subsoil and small areas where dolomite bedrock is at a depth of 40 to 60 inches. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderate in this Onaway soil. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate. The surface layer is difficult to till because plowing has mixed in the firm clay loam subsoil material. It also tends to crust after heavy rains.

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a moderate hazard of further erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture or hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration and the establishment of seedlings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of slope and the moderate permeability. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material or placing the absorption field on the contour. The permeability problem can be overcome by building a filtering mound of suitable material or by enlarging the absorption field. This soil is moderately suited to dwellings with or without basements because of slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil is moderately suited to local roads and streets because of the slope and moderate potential for frost action. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material and by constructing roads on the contour. The frost problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIIe-1 and woodland suitability subclass 2o.

OeD2—Onaway fine sandy loam, 12 to 20 percent slopes, eroded. This moderately steep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 60 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 7 inches thick. In most cultivated areas, plowing has mixed reddish brown, loam subsoil material with the surface layer. The subsoil is about 13 inches thick. It is reddish brown, firm clay loam. The substratum, to a depth of about 60 inches, is reddish brown, friable loam. Some areas are uneroded. In some places the surface layer is silt loam or loam. Also, in some areas the depth to free carbonates is less than 15 inches.

Included with this soil in mapping are small areas of Fairport and Menominee soils. The well drained Fairport soils are similar to the Onaway soil in position on the landscape but have dolomite bedrock at depths of 20 to 40 inches. The well drained Menominee soils are in similar landscape positions but have a 20- to 40-inch-thick sandy mantle. Other inclusions are small sloping, steep, and severely eroded areas of Onaway fine sandy loam. Also included are small areas that have more sand and less clay in the subsoil and small areas where dolomite bedrock is at a depth of about 40 to 60 inches. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderate in this Onaway soil. The available water capacity is moderate, and surface runoff from cultivated areas is rapid. Organic matter content of the surface layer is moderately low or moderate. The surface layer is difficult to till because plowing has mixed in the firm clay loam subsoil material. It also tends to crust after heavy rains.

Some areas are used for crops and pasture. Some areas are in woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a severe hazard of further erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture and hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Soil-related problems of forest management are associated with steepness of slope; mortality of seedlings on hot, dry sites; and brush encroachment following harvest. Planting trees on the contour and careful location of skid roads during harvest will minimize erosion and improve equipment trafficability. Seedling mortality rates on south- and west-facing slopes can be reduced by careful planting of vigorous nursery stock. Vegetation that competes with planted seedlings or natural reproduction following harvest can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material or by selecting a less sloping site. This soil is poorly suited to dwellings with or without basements and local roads and streets because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. Local roads and streets can also be constructed on the contour.

This soil is in capability unit IVe-1 and woodland suitability subclass 2r.

OeE—Onaway fine sandy loam, 20 to 35 percent slopes. This steep and very steep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 30 acres in size.

Typically, the surface layer is very dark brown fine sandy loam about 3 inches thick. The subsoil is about 20 inches thick. It is dark brown, friable loam in the upper part and is mostly reddish brown, firm loam in the lower part. The substratum, to a depth of about 60 inches, is reddish brown, friable sandy loam. Some areas are eroded. In some places the surface layer is silt loam or loam. In some areas the depth to free carbonates is more than 30 inches, and in some the substratum is stratified silt and very fine sand.

Included with this soil in mapping are small moderately steep areas and severely eroded areas of Onaway fine sandy loam and small areas that have slopes greater than 35 percent. Also included are small areas that have more sand and less clay in the subsoil and small areas where dolomite bedrock is at a depth of 20 to 60 inches. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderate in this Onaway soil. The available water capacity is moderate, and surface runoff from cultivated areas is very rapid. Organic matter content of the surface layer is moderately low or moderate.

Most areas are in native woodland. Some areas are used for crops and pasture. This soil is generally unsuitable for row crops. Where this soil is cultivated, there is a very severe hazard of erosion and it is subject to soil blowing. This soil is suited to grasses and legumes for hay and pasture. Where it is used for these crops, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Soil-related problems of forest management are associated with steepness of slope; mortality of seedlings on hot, dry sites; and brush encroachment following harvest. Planting trees on the contour and careful location of skid roads will minimize erosion and improve equipment trafficability. Seedling mortality rates on south- and west-facing slopes can be reduced by careful planting of vigorous nursery stock. Vegetation that competes with planted seedlings or natural regeneration following harvest can be controlled through the use of suitable herbicides or removed mechanically.

This soil is generally unsuited to septic tank absorption fields and dwellings with or without basements because of slope. This problem is difficult to overcome, and a different building site should be selected. This soil is poorly suited to local roads and streets because of slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material or constructing roads on the contour.

This soil is in capability unit VIe-1 and woodland suitability subclass 2r.

OfB—Onaway fine sandy loam, cobbly substratum, 1 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on 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 7 inches thick. The subsurface layer is mostly brown, very friable fine sandy loam about 6 inches thick. The subsoil is about 13 inches thick. It is reddish brown, friable clay loam in the upper part and reddish brown, friable loam in the lower part. The substratum, to a depth of about 60 inches, is reddish brown, very friable cobbly sandy loam. Some areas are eroded, and some have slopes less than 1 percent. In some places the surface layer is loam, and in some places the substratum is not cobbly.

Included with this soil in mapping are small areas of Fairport, Shiocton Variant, and Solona soils. The well drained Fairport soils are similar to the Onaway cobbly substratum soil in position on the landscape but have dolomite bedrock at depths between 20 and 40 inches. The somewhat poorly drained Shiocton Variant and Solona soils are in slightly lower landscape positions in drainageways and depressions. Also included are small sloping areas and severely eroded areas of Onaway fine sandy loam, cobbly substratum, and small areas where dolomite bedrock is at a depth of 40 to 60 inches. These inclusions make up 5 to 10 percent of the unit.

Permeability is moderate in this Onaway soil. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled.

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration. The cobbles in the substratum may interfere with some conservation practices such as the installation of grassed waterways and diversions.

Where this soil is used as pasture and hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of moderate permeability and because cobbles in the substratum hinder installation. These problems can be overcome by building a filtering mound of suitable material. The permeability problem can also be overcome by enlarging the absorption field. This soil is suited to dwellings with or without basements. It is moderately suited to local roads and streets because of moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIe-1 and woodland suitability subclass 2o.

OfC2—Onaway fine sandy loam, cobbly substratum, 6 to 12 percent slopes, eroded. This sloping, 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 7 inches thick. In most cultivated areas, plowing has mixed some reddish brown, clay loam subsoil material into the surface layer. The subsoil is about 18 inches thick. It is mostly reddish brown, firm clay loam in the upper part and is reddish brown, friable sandy clay loam in the lower part. The substratum, to a depth of about 60 inches, is reddish brown, friable cobbly sandy loam. Some areas are uneroded. In some places the surface layer is loam, and in some places the substratum is not cobbly.

Included with this soil in mapping are small areas of Fairport soils. The well drained Fairport soils are similar to the Onaway cobbly substratum soil in position on the landscape but have dolomite bedrock at depths between 20 and 40 inches. Also included are small gently sloping, moderately steep, and severely eroded areas of Onaway fine sandy loam, cobbly substratum, and small areas where dolomite bedrock is at a depth of 40 to 60 inches. These inclusions make up 5 to 10 percent of the unit.

Permeability is moderate in this Onaway soil. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate. The surface layer is difficult to till because plowing has mixed in the firm clay loam subsoil material. It also tends to crust after heavy rains.

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a moderate hazard of further erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration. The cobbles in the substratum may interfere with some conservation practices such as the installation of grassed waterways and diversions.

Where this soil is used as pasture and hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration and the establishment of seedlings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of the slope and moderate permeability and because cobbles in the substratum hinder installation. These problems can be overcome by building a filtering mound of suitable material or by reducing the slope by cutting or cutting and adding fill material. The permeability problem can also be overcome by enlarging the absorption field. This soil is moderately suited to dwellings with or without basements because of slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil is moderately suited to local roads and streets because of the slope and moderate potential for frost action. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material and by constructing roads on the contour. The frost problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIIe-1 and woodland suitability subclass 2o.

Pt—Pits. These are areas where sand and gravel, sand, glacial till, or, in some places, dolomite bedrock has been quarried to a depth of at least several feet. Individual areas are irregular in shape and range from about 5 to 160 acres in size.

Pits are in or near areas of Antigo, Boyer, Brill, Comwell, Croswell, Elderon, Fairport, Lorenzo Variant, Mahtomedi, Menahga, Oesterle, Rosholt, Rousseau, Scott Lake, Shawano, and Rubicon soils.

Typically, the material in the bottom and sidewalls is stratified sand and gravel, sand, loamy glacial till or, to a lesser extent, dolomite.

Included with this unit in mapping are areas of spoil, which includes soil pushed from the pit area before excavation and piles of material that was discarded because it did not contain enough gravel or for some other reason. Also included are stones or boulders too large to crush.

Many pits are at the site of active quarries; others have been abandoned and are grown up in brush and weeds. Some abandoned pits have water in them. The main management concern is reclamation of the area after excavation. To support a plant cover, most areas require land shaping and the addition of suitable topsoil.

The suitability of this unit for septic tank absorption fields, dwellings, and local roads and streets should be decided by onsite investigation.

Pits are not assigned to a capability unit or to a woodland suitability subclass.

PvA—Plover loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on low-lying flats, in drainageways and depressions, and on concave foot slopes. Some areas are subject to flooding. Most areas are irregular in shape and range from about 3 to 45 acres in size.

Typically, the surface layer is dark brown loam about 8 inches thick. The next layer is brown, mottled, very friable fine sandy loam about 2 inches thick. The subsurface layer is mostly pinkish gray, mottled, very friable fine sandy loam about 10 inches thick. The subsoil is about 16 inches thick. It is mostly brown, mottled, friable fine sandy loam in the upper part; brown, mottled, friable sandy loam in the middle; and brown, mottled, very friable loamy sand in the lower part. The substratum, to a depth of about 60 inches, is light brown, mottled, friable very fine sand in the upper part and yellowish red silt loam in the lower part. In some places the surface layer is silt loam. In some areas the substratum is sandy loam.

Included with this soil in mapping are small areas of Alban soils. The moderately well drained Alban soils are in higher landscape positions than is the Plover soil. Also included are some areas that are very stony. These inclusions make up 5 to 10 percent of the unit.

Permeability is moderate in this Plover soil. The available water capacity is high, and surface runoff is slow. Unless this soil is drained, the water table is at a depth of 1 to 3 feet during wet seasons. This limits the depth of root penetration. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can easily be tilled.

Most areas are used for crops and pasture. Some areas are in native woodland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage. Where tile drainage is used, loose sand will enter the tile lines unless the tile are covered with a suitable filter. Unless protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks will cave and plug the ditch. Regular additions of organic material help to maintain fertility and good tilth.

Where drained, this soil is suited to pasture and hayland. Erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in erosion. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and plant cover in good condition.

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

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table. Where the water table is at a depth of more than 2 feet this problem can be overcome by building a filtering mound of suitable material. It may also be possible to pump the effluent to an absorption field located on a more suitable soil nearby. This soil is poorly suited to dwellings with or without basements because of the seasonal high water table and flooding. The seasonal water table can be lowered by installing a subsurface drainage system with a gravity or other dependable outlet, raising the site elevation by adding fill material, and by constructing the basement above the level of wetness. Floodwater can be diverted by shaping the construction site and installing diversions and dikes. This soil is poorly suited to local roads and streets because of the high potential for frost action. This problem can be overcome by subsurface drainage of the roadbed and by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIw-2 and woodland suitability subclass 2o.

RmD—Rock outcrop-Rosholt Variant complex, 2 to 35 percent slopes. This unit consists of gently sloping to very steep areas of Rock outcrop and well drained Rosholt Variant soil on convex ridges and side slopes (fig. 8). Most areas of this unit are irregular in shape and range from about 3 to 130 acres in size. Individual areas are 50 to 75 percent Rock outcrop and 25 to 45 percent Rosholt Variant soil. Areas of Rock outcrop and the Rosholt Variant soil occupy similar landscape positions and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

The Rock outcrop part of this unit consists of bare granite bedrock. Some areas are vertical or near vertical bedrock escarpments.

Typically, the Rosholt Variant soil has a very dark brown, silt loam surface layer about 2 inches thick. The subsurface layer is dark reddish gray, friable silt loam about 2 inches thick. The subsoil is about 18 inches thick. It is dark reddish brown, friable silt loam in the upper part and dark brown, friable silt loam in the lower part. Granite bedrock is at a depth of about 22 inches. In some small areas this soil is more than 40 inches deep over granite bedrock.

Included with this unit in mapping are small areas where the soil is less than 20 inches deep over granite bedrock. Some areas have stones on the surface. Also included are small areas that have mottles in the subsoil. These inclusions make up 5 to 10 percent of the unit.

Permeability is moderate in the Rosholt Variant soil. The available water capacity is low. Surface runoff is medium to very rapid. Depth of the root zone is limited by the granite bedrock, but some roots extend into crevices in the bedrock. Organic matter content of the surface layer is moderately low or moderate.

Most soil areas in this unit are in native woodland. Some areas are used for unimproved pasture. Areas of Rock outcrop are unsuited to growing cultivated crops, hay, pasture, and trees. The Rosholt Variant soil is poorly suited to cultivated crops because of the many areas of Rock outcrop. Areas of the Rosholt Variant soil are suited to pasture. Where used for pasture, erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in erosion. Grazing when the surface layer is wet causes surface compaction, which increases runoff and the hazard of erosion. Fertilization, renovation, and controlled grazing help to keep the soil and plant cover in good condition.

The Rosholt Variant soil is suited to trees. Soil-related problems of forest management are associated with steepness of slope, where the slope is over about 12 percent, and plant competition following harvest. Planting trees on the contour and careful location of skid roads during harvest will minimize erosion. Seedling survival rates on steeper slopes facing south or west can be improved by careful planting of vigorous planting stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by the use of suitable herbicides or mechanical removal. Skidding operations may expose sufficient mineral soil to allow adequate regeneration.

Areas of Rock outcrop are unsuited to septic tank absorption fields, dwellings with or without basements, and local roads and streets because of rock and

Figure 8.—Typical landscape of Rock outcrop-Rosholt Variant complex. Areas of this complex are used almost entirely for woodland and wildlife habitat. A few areas are used for unimproved pasture.

steepness of slope. These problems are difficult to overcome for these uses, and a different site on a suitable soil should be selected.

The Rosholt Variant soil in this unit is poorly suited to septic tank absorption fields because of the depth to bedrock. This problem can be overcome by building a filtering mound of suitable material. Moderately steep, steep, and very steep areas are also poorly suited to this use because of slope. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material, but the underlying bedrock will limit the depth of cuts. Gently sloping areas of the Rosholt Variant soil are poorly suited to dwellings with basements and are moderately suited to dwellings without basements and local roads and streets because of the depth to bedrock. Sloping areas of the Rosholt Variant soil are poorly suited to dwellings with basements because of depth to bedrock. They are moderately suited to dwellings without basements and local roads and streets because of the depth to rock and the slope. They are also moderately suited to local roads and streets because of the moderate potential for frost action. Moderately steep, steep, and very steep areas of the Rosholt Variant soil are poorly suited to dwellings with basements because of slope and depth to bedrock. They are poorly suited to dwellings without basements and local roads and streets because of slope. The depth to bedrock problem for all the above uses can be overcome by adding fill material to increase the depth to bedrock or by excavating the bedrock by blasting or with a jackhammer or other suitable digging equipment. The frost problem for local roads and streets can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel. The slope problem for all the above uses can be overcome by reducing the slope by cutting or cutting and adding fill material, but the underlying bedrock may prevent this. Where the slope is greater than about 20 percent, the slope problem is so difficult to overcome that a different building site should be selected. The slope problem for local roads and streets can also be overcome by constructing roads on the contour.

This unit is in capability unit VIe-2. The Rosholt Variant soil is in woodland suitability subclass 2d; Rock outcrop is not assigned to a woodland suitability subclass.

RoA—Rosholt fine sandy loam, 0 to 2 percent slopes. This nearly level, well drained soil is on flats. Most areas are irregular in shape and range from about 3 to 120 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 11 inches thick. The subsurface layer is mostly yellowish brown, friable sandy loam about 10 inches thick. The subsoil is about 23 inches thick. It is brown, friable sandy loam in the upper part; brown and strong brown, friable gravelly sandy loam in the middle; and dark reddish brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is strong brown, loose sand. In some places the loamy mantle is less than 20 inches thick, and in some it is more than 36 inches thick. Some areas of this soil are gently sloping. In some places the surface layer is loam or silt loam.

Included with this soil in mapping are small areas of Antigo, Oesterle, and Scott Lake soils. The somewhat poorly drained Oesterle soils occupy lower landscape positions than do the Rosholt soil and are in drainageways and depressions. The well drained Antigo soils are similar to the Rosholt soil in position on the landscape but have more clay and more silt in the subsoil. The moderately well drained Scott Lake soils occupy similar or slightly lower landscape positions. Also included are small areas of Rosholt soils that are very stony. These inclusions make up about 10 to 15 percent of the unit.

In this Rosholt soil the permeability is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is low, and surface runoff is slow. Depth of root penetration is limited by the underlying sand. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and is easily tilled.

Most areas are used for crops and pasture. Some areas are in woodland. This soil is suited to corn and small grains and to grasses and legumes for hay and pasture. Erosion is generally not a problem, but this soil is subject to soil blowing. Soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, wind stripcropping, and field windbreaks. Regular additions of organic matter help maintain fertility and good tilth and increase water infiltration.

This soil is suited to hayland and pasture, but forage yields are generally somewhat limited unless this soil is fertilized and irrigated. Soil blowing is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help to keep the soil and plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is suited to dwellings with or without basements. It is moderately suited to local roads and streets because of the moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIs-1 and woodland suitability subclass 2o.

RoB—Rosholt fine sandy loam, 2 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 400 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsurface layer is brown, friable fine sandy loam about 5 inches thick. The subsoil is about 21 inches thick. It is mostly dark brown, friable fine sandy loam and sandy loam in the upper part and is brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand and gravel in the upper part and yellowish brown, loose coarse and medium sand in the lower part. Some small areas are eroded. In places the surface layer is silt loam, loam, or sandy loam. In some places the subsoil contains more silt and less sand. In some places the substratum contains thin strata of loamy sand or sandy loam, and in some the substratum is sandy loam or loamy sand till.

Included with this soil in mapping are small areas of Cromwell, Mahtomedi, Oesterle, Rosholt Variant, and Scott Lake soils. The somewhat excessively drained Cromwell soils are similar to the Rosholt soil in position on the landscape but have a loamy mantle less than 24 inches thick. The excessively drained Mahtomedi soils occupy similar landscape positions but are sandy throughout. The somewhat poorly drained Oesterle soils occupy lower landscape positions in drainageways and depressions. The well drained Rosholt Variant soils are similar to the Rosholt soil in position on the landscape but have granite bedrock at a depth of 20 to 40 inches. The moderately well drained Scott Lake soils are in similar or slightly lower landscape positions. Other inclusions are small sloping areas and severely eroded areas of Rosholt soils and some areas that are very stony. Also included are small areas where granite bedrock is at a depth of 40 to 60 inches. These inclusions make up about 10 to 15 percent of the unit.

In this Rosholt soil the permeability is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is low, and surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying sand and gravel and coarse sand. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and is easily tilled.

Most areas are used for crops and pasture. Some areas are in woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields during most seasons are limited by the low available water capacity. With irrigation and intensive management, this soil can produce better and more consistent yields. Where this soil is cultivated, there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production.

This soil is suited to pasture and hayland, but forage yields are generally somewhat limited unless this soil is fertilized and irrigated. Erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

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

This soil readily accepts the effluent from septic tank absorption fields. Septic tank absorption fields will function satisfactorily, but there is a danger of pollution of the ground water. This soil is suited to dwellings with or without basements. It is moderately suited to local roads and streets because of the moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

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

RoC—Rosholt fine sandy loam, 6 to 12 percent slopes. This sloping, well drained soil is on convex side slopes. Most areas are long and narrow to irregular in shape and range from about 3 to 200 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 7 inches thick. The subsurface layer is brown, friable fine sandy loam about 4 inches thick. The subsoil is about 22 inches thick. It is mostly dark brown, friable fine sandy loam and sandy loam in the upper part and brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand and gravel. Some small areas are eroded. In some places the surface layer is silt loam, loam, or sandy loam. In some places the subsoil contains more silt and less sand. In some places the substratum contains thin strata of loamy sand or sandy loam, and in some the substratum is loamy sand or sandy loam till.

Included with this soil in mapping are small areas of Cromwell, Mahtomedi, and Rosholt Variant soils. The somewhat excessively drained Cromwell soils are similar to the Rosholt soil in position on the landscape but have a loamy mantle less than 24 inches thick. The excessively drained Mahtomedi soils occupy similar landscape positions but are sandy throughout. The well drained Rosholt Variant soils are in similar landscape positions but have granite bedrock at a depth of 20 to 40 inches. Other inclusions are small gently sloping, moderately steep, and severely eroded areas of Rosholt soils, and some areas that are very stony. Also included are small areas where granite bedrock is at a depth of 40 to 60 inches. These inclusions make up about 10 to 15 percent of the unit.

In this Rosholt soil the permeability is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is low, and surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying sand and gravel. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and is easily tilled.

Most areas are used for crops and pasture. Many areas are in woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields during most seasons are limited by the low available water capacity. With irrigation and intensive management, this soil can produce better and more consistent yields. Where this soil is cultivated, there is a moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production.

This soil is suited to pasture and hayland, but forage yields are generally somewhat limited unless this soil is fertilized and irrigated. Erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

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

This soil is moderately suited to septic tank absorption fields because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is moderately suited to dwellings with or without basements because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil is moderately suited to local roads and streets because of the slope and moderate potential for frost action. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material or constructing roads on the contour. The frost problem can be overcome by covering or replacing the upper part of the soil with a base material such as sand or gravel.

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

RoD—Rosholt fine sandy loam, 12 to 20 percent slopes. This moderately steep, well drained soil is on convex side slopes. Most areas are long and narrow or irregular in shape and range from about 3 to 100 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 3 inches thick. The subsurface layer is brown, friable fine sandy loam about 5 inches thick. The subsoil is about 20 inches thick. It is mostly dark brown, friable fine sandy loam and sandy loam in the upper part and brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand and gravel. Some small areas are eroded. In some places the surface layer is silt loam, loam, or sandy loam. In some places the subsoil contains more silt and less sand. In some places the substratum contains layers of loamy sand or sandy loam, and in some it is sandy loam or loamy sand.

Included with this soil in mapping are small areas of Cromwell, Mahtomedi, and Rosholt Variant soils. The somewhat excessively drained Cromwell soils are similar to the Rosholt soil in position on the landscape but have a loamy mantle less than 24 inches thick. The excessively drained Mahtomedi soils occupy similar landscape positions but are sandy throughout. The well drained Rosholt Variant soils are in similar landscape positions but have granite bedrock at a depth of 20 to 40 inches. Other inclusions are small sloping areas and severely eroded areas of Rosholt soils, and small areas with slopes greater than 20 percent. Also included are some small areas that are very stony and small areas where granite bedrock is at a depth of 40 to 60 inches. These inclusions make up about 10 to 15 percent of the unit.

In this Rosholt soil the permeability is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is low, and surface runoff from cultivated areas is rapid. Depth of root penetration is limited by the underlying sand and gravel. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and is easily tilled.

Most areas are used for pasture and woodland. Some areas are in crops. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Crop yields during most seasons are limited by the low available water capacity. Where this soil is cultivated, there is a severe hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways.

Use of the soil as pasture or hayland is also effective in controlling erosion and soil blowing, but forage yields are generally limited by the low available water capacity. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to trees. Soil-related problems of forest management are associated with steepness of slope or plant competition following harvest. Planting trees on the contour and careful location of skid roads during harvest will minimize erosion. Seedling survival rates can be improved on steeper slopes facing south or west by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by the use of suitable herbicides or mechanical removal. Skidding operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to septic tank absorption fields because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material, or perhaps a less sloping site can be selected. This soil readily accepts effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is poorly suited to dwellings with or without basements and local roads and streets because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material, or perhaps a less sloping site can be selected. This problem can be minimized for local roads and streets by constructing roads on the contour.

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

RpB—Rosholt-Elderon complex, 2 to 6 percent slopes. This unit consists of gently sloping, well drained and somewhat excessively drained soils on convex side slopes. Most areas are irregular in shape and range from about 3 to 40 acres in size. Individual areas are 40 to 80 percent Rosholt soil and 20 to 50 percent Elderon soil. Areas of these two soils occupy similar landscape positions and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Rosholt soil has a dark brown, sandy loam surface layer about 8 inches thick. The subsurface layer is brown, friable fine sandy loam about 5 inches thick. The subsoil is about 21 inches thick. It is mostly brown, friable fine sandy loam and sandy loam in the upper part and is strong brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is strong brown and yellowish brown, loose sand and gravel. In some places the surface layer is loam, silt loam, or fine sandy loam.

Typically, the Elderon soil has a very dark grayish brown, gravelly sandy loam surface layer about 7 inches thick. The subsoil is about 37 inches thick. It is dark reddish brown, very friable very cobbly coarse sandy loam in the upper part and is dark brown and brown, very friable very cobbly loamy coarse sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose very cobbly coarse sand. In some places the surface layer is silt loam, loam, or fine sandy loam.

Included with this unit in mapping are small areas of Mahtomedi and Menahga soils. The excessively drained Mahtomedi and Menahga soils are similar to the Rosholt and Elderon soils in position on the landscape but are sandy throughout. Also included are many areas of Elderon and Rosholt soils that are very stony. These inclusions make up 5 to 10 percent of the unit.

Permeability of the Rosholt soil is moderately rapid in the subsoil and very rapid in the substratum. Permeability of the Elderon soil is rapid in the subsoil and very rapid in the substratum. The available water capacity is low in the Rosholt soil and very low in the Elderon soil. Surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying sand and gravel or cobbly coarse sand. Organic matter content of the surface layer is moderately low or moderate.

Some areas are used for crops and pasture, and some are in native woodland. These soils are suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields during most seasons are limited by the low or very low available water capacity. With irrigation and intensive management, these soils can produce better and more consistent yields. Where these soils are cultivated, there is a slight or moderate hazard of erosion and they are subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions and grassed waterways. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production.

These soils are suited to pasture and hayland, but forage yields are generally somewhat limited unless they are fertilized and irrigated. Erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

These soils are suited to trees. Competing vegetation can slow natural regeneration or the establishment of plantings. It can be controlled through the use of suitable herbicides or removed mechanically.

These soils readily accept the effluent from septic tank absorption fields but do not adequately filter it. This results in a danger of ground water pollution. These soils are suited to dwellings with or without basements. The Elderson soil is suited to local roads and streets. Rosholt soil is moderately suited to local roads and streets because of the moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

These soils are in capability unit IIe-2. The Rosholt soil is in woodland suitability subclass 2o; the Elderon soil is in 3o.

RpC—Rosholt-Elderon complex, 6 to 12 percent slopes. This unit consists of sloping, well drained and somewhat excessively drained soils on convex side slopes. Most areas are irregular in shape and range from about 3 to 55 acres in size. Individual areas are 40 to 80 percent Rosholt soil and 20 to 50 percent Elderon soil. Areas of these two soils occupy similar landscape positions and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Rosholt soil has a dark brown, sandy loam surface layer about 8 inches thick. The subsurface layer is brown, friable fine sandy loam about 5 inches thick. The subsoil is about 21 inches thick. It is mostly brown, friable fine sandy loam and sandy loam in the upper part and is strong brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is strong brown and yellowish brown, loose sand and gravel. In some places the surface layer is loam, silt loam, or fine sandy loam.

Typically, the Elderon soil has a very dark grayish brown gravelly sandy loam surface layer about 7 inches thick. The subsoil is about 37 inches thick. It is dark reddish brown, very friable very cobbly coarse sandy loam in the upper part and is dark brown and brown, very friable very cobbly loamy coarse sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose very cobbly coarse sand. In some places the surface layer is silt loam, loam, or fine sandy loam.

Included with this unit in mapping are small areas of Mahtomedi and Menahga soils. The excessively drained Mahtomedi and Menahga soils are similar to the Rosholt and Elderon soils in position on the landscape but are sandy throughout. Also included are many areas of Rosholt and Elderon soils that are very stony and some areas with slopes greater than 12 percent. These inclusions make up 5 to 10 percent of the unit.

Permeability of the Rosholt soil is moderately rapid in the subsoil and very rapid in the substratum. Permeability of the Elderon soil is rapid in the subsoil and very rapid in the substratum. The available water capacity is low in the Rosholt soil and very low in the Elderon soil. Surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying sand and gravel or cobbly coarse sand. Organic matter content of the surface layer is moderately low or moderate.

Some areas are used for crops and pasture; some are in native woodland. These soils are suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields during most seasons are limited by the low or very low available water capacity. With irrigation and intensive management, these soils can produce better and more consistent yields. Where these soils are cultivated, there is a moderate hazard of erosion and they are subject to soil blowing. Erosion and soil blowing can be controlled by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production.

These soils are suited to pasture and hayland, but forage yields are generally somewhat limited unless they are fertilized and irrigated. Erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

These soils are suited to trees. Competing vegetation can slow natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

These soils are moderately suited to septic tank absorption fields because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. These soils readily accept the effluent from septic tank absorption fields but do not adequately filter it. This results in a danger of ground water pollution. These soils are moderately suited to dwellings with or without basements because of the slope. This problem can be overcome for these uses by reducing the slope by cutting or cutting and adding fill material. These soils are moderately suited to local roads and streets because of the slope and, in the Rosholt soil, because of the moderate potential for frost action. The frost problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material, or by constructing roads on the contour.

These soils are in capability unit IIIe-2. The Rosholt soil is in woodland suitability subclass 2o; the Elderon soil is in 3o.

RrD—Rosholt-Rock outcrop complex, 2 to 35 percent slopes. This unit consists of gently sloping to very steep, well drained soils and areas of Rock outcrop on convex side slopes. Most areas are irregular in shape and range from about 3 to 35 acres in size. Individual areas are 50 to 75 percent Rosholt soil and 25 to 45 percent Rock outcrop. Areas of these two soils are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Rosholt soil has a dark brown, sandy loam surface layer about 8 inches thick. The subsurface layer is brown, friable fine sandy loam about 5 inches thick. The subsoil is about 21 inches thick. It is mostly dark brown, friable fine sandy loam and sandy loam in the upper part and is brown, very friable gravelly loamy sand in the lower part. The substratum, to a depth of about 60 inches, is brown, loose sand and gravel in the upper part and yellowish brown, loose coarse and medium sand in the lower part. In some places the surface layer is loam, sandy loam, or loamy sand. Some small areas are underlain by granite bedrock at depths of less than 60 inches.

The Rock outcrop part of this unit consists of areas of bare granite bedrock. Some areas are vertical, or nearly vertical, bedrock escarpments.

Included with this unit in mapping are small areas of Rosholt Variant soils. The well drained Rosholt Variant soils are similar to this unit in position on the landscape but are underlain by granite bedrock at depths of 20 to 40 inches. Other inclusions are small areas that are less than 20 inches deep over granite bedrock and some areas that are very stony. Also included are some areas where the water table is at depths as shallow as 3 feet during wet seasons. These inclusions make up 5 to 10 percent of the unit.

In this Rosholt soil the permeability is moderately rapid in the subsoil and very rapid in the substratum. The available water capacity is low. Surface runoff is medium. Depth of root penetration is limited by the underlying sand and gravel and coarse sand. Organic matter content of the surface layer is moderately low or moderate.

Many areas are in native woodland. Some areas are used as pasture or hayland, and a few areas are used for cultivated crops. Areas of Rock outcrop are unsuitable for growing cultivated crops, hay, pasture, and trees. The Rosholt soil is poorly suited to cultivated crops because of the many areas of Rock outcrop. Areas of the Rosholt soil are suited to pasture, and some of the less sloping areas are suited to hayland. Erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to keep the soil and the plant cover in good condition.

The Rosholt soil is suited to trees. Soil-related problems of forest management are associated with steepness of slope, where slope is over about 12 percent, and plant competition following harvest. Planting trees on the contour and careful location of skid roads during harvest will minimize erosion. Seedling survival rates on steeper slopes facing south or west can be improved by careful planting of vigorous nursery stock. Competing vegetation that interferes with natural regeneration following harvest can be controlled by the use of suitable herbicides or mechanical removal. Skidding operations may expose sufficient mineral soil to allow adequate regeneration.

Areas of Rock outcrop are unsuited to growing cultivated crops, hay, pasture, or trees.

Moderately steep, steep, and very steep areas of Rosholt soil are poorly suited to septic tank absorption fields because of slope. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material, but if the slope is greater than about 20 percent the problem is so difficult to overcome that a different building site should be selected. This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of ground water pollution. Gently sloping areas of the Rosholt soil are suited to dwellings with or without basements. Sloping areas are moderately suited to dwellings with or without basements because of slope. Moderately steep, steep, and very steep areas of the Rosholt soil are poorly suited to all these uses because of slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material, but where the slope is greater than about 20 percent a different site should be selected. Gently sloping and sloping areas of the Rosholt soil are moderately suited to local roads and streets because of the moderate potential for frost action. Sloping areas are also moderately suited to this use because of slope, and moderately steep, steep, and very steep areas are poorly suited to this use because of slope. The frost problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material, or by constructing roads on the contour.

Areas of Rock outcrop are unsuited to septic tank absorption fields, dwellings with or without basements, and local roads and streets because of the rock and steepness of slope. These problems are difficult to overcome for these uses, and a different site or a more suitable soil should be selected.

This unit is in capability unit VIe-2. The Rosholt soil is in woodland suitability subclass 2r. Rock outcrop is not assigned to a woodland suitability subclass.

RsA—Rousseau loamy fine sand, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on low-lying flats and in drainageways and depressions. Most areas are irregular in shape and range from about 3 to 900 acres in size.

Typically, the surface layer is dark brown loamy fine sand about 10 inches thick. The subsoil is about 22 inches thick. It is strong brown, very friable fine sand in the upper part and brown, mottled, very friable fine sand in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, loose fine sand. Some areas are eroded, and some are gently sloping. Some areas have loamy layers in the substratum.

Included with this soil in mapping are small areas of Shawano and Wainola soils. The excessively drained Shawano soils are similar to, or slightly higher than, the Rousseau soil in position on the landscape. The somewhat poorly drained Wainola soils are in slightly lower positions in drainageways and depressions. These inclusions make up 5 to 10 percent of the unit.

Permeability is rapid in this Rousseau soil. The available water capacity is low, and surface runoff is slow. The water table is at depths as shallow as 3 feet during wet seasons. Organic matter content of the surface layer is low or very low. The surface layer is very friable and is easily tilled.

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields are generally limited by the low available water capacity. This soil is suited to sprinkler irrigation. Where it is fertilized and irrigated, this soil can produce better and more consistent yields. Erosion is generally not a problem, but this soil is subject to soil blowing. Soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, wind stripcropping, and field windbreaks. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability of this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Where this soil is used as pasture and hayland, soil blowing is generally not a problem. Forage yields, however, are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, irrigation, and controlled grazing help to maintain plant cover.

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

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and rapid permeability. These problems can be overcome by building a filtering mound of suitable material. This soil is suited to dwellings without basements and local roads and streets. It is moderately suited to dwellings with basements because of the seasonal high water table. This problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet, or by constructing the basement above the level of wetness.

This soil is in capability unit IVs-3 and woodland suitability subclass 1s.

RsB—Rousseau loamy fine sand, 2 to 6 percent slopes. This gently sloping, moderately well drained soil is on convex side slopes and concave foot slopes. Most areas are irregular in shape and range from about 3 to 400 acres in size.

Typically, the surface layer is dark brown loamy fine sand about 12 inches thick. The subsoil is about 21 inches thick. It is dark brown, very friable fine sand in the upper part and brown, mottled, very friable fine sand in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, loose fine sand. Some small areas are eroded, and some are nearly level. Some areas have loamy layers in the substratum.

Included with this soil in mapping are small areas of Shawano and Wainola soils. The excessively drained Shawano soils are similar to, or slightly higher than, the Rousseau soil in position on the landscape. The somewhat poorly drained Wainola soils are in slightly lower positions in drainageways and depressions. Also included are severely eroded areas and some small areas with slopes greater than 6 percent. These inclusions make up 5 to 10 percent of the unit.

Permeability is rapid in this Rousseau soil. The available water capacity is low, and surface runoff from cultivated areas is medium. The water table is at depths as shallow as 3 feet during wet seasons. Organic matter content of the surface layer is low or very low. The surface layer is very friable and is easily tilled.

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields are generally limited by the low available water capacity. This soil is suited to sprinkler irrigation. Where fertilized and irrigated, it can produce better and more consistent yields. Where this soil is cultivated, there is a slight hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residue, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability of this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Where this soil is used as pasture and hayland, soil blowing is generally not a problem. Forage yields, however, are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, irrigation, and controlled grazing help to maintain plant cover.

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

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and rapid permeability. These problems can be overcome by building a filtering mound of suitable material. This soil is suited to dwellings without basements and local roads and streets. It is moderately suited to dwellings with basements because of the seasonal high water table. This problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet, or by constructing the basement above the level of wetness.

This soil is in capability unit IVs-3 and woodland suitability subclass 1s.

RuB—Rubicon sand, 1 to 6 percent slopes. This nearly level and gently sloping, excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 175 acres in size.

Typically, the surface layer is very dark brown sand about 1 inch thick. The subsurface layer is brown, very friable sand about 3 inches thick. The subsoil is about 24 inches thick. It is dark reddish brown, very friable sand in the upper part; reddish brown, very friable sand in the middle; and reddish brown, loose sand in the lower part. The substratum, to a depth of about 60 inches, is strong brown and brown, loose sand. In some areas the surface layer is loamy sand.

Included with this soil in mapping are small areas of Au Gres and Croswell soils. The somewhat poorly drained Au Gres soils are lower than the Rubicon soil in position on the landscape and are in drainageways and depressions. The moderately well drained Croswell soils are similar to, or slightly lower than, the Rubicon soil in position on the landscape. Also included are some small sloping areas of Rubicon sand and some areas that are very stony. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in this Rubicon soil. The available water capacity is low, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is low. The surface layer is very friable and can be easily tilled.

Many areas are used for crops and pasture. Some areas are in native woodland, and some areas have been planted to pine trees. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields are generally limited by the low available water capacity. This soil is suited, however, to sprinkler irrigation. If irrigated, it can produce better and more consistent yields. Where this soil is cultivated, there is a slight hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability in this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of the soil as pasture or hayland is also effective in controlling soil blowing. Yields are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to trees. Poor seedling survival rates in dry years can be offset by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration or the establishment of plantings, can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is suited to dwellings with or without basements and to local roads and streets.

This soil is in capability unit IVs-4 and woodland suitability subclass 3s.

RuC—Rubicon sand, 6 to 12 percent slopes. This sloping, excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 50 acres in size.

Typically, the surface layer is very dark gray sand about 2 inches thick. The subsurface layer is pinkish gray, very friable sand about 2 inches thick. The subsoil is about 14 inches thick. It is dark reddish brown, very friable sand in the upper part and brown, loose sand in the lower part. The substratum, to a depth of about 60 inches, is light brown, loose sand. In some areas the surface layer is loamy sand.

Included with this soil in mapping are small areas of Cromwell soils. The somewhat excessively drained Cromwell soils are similar to the Rubicon soil in position on the landscape but have a 12- to 24-inch-thick sandy loam mantle. Also included are some small, nearly level and gently sloping areas and moderately steep areas of Rubicon sand and some areas that are very stony. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in this Rubicon soil. The available water capacity is low, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is low. The surface layer is very friable and can be easily tilled.

Most areas are in native woodland, and some areas have been planted to pine trees. Some areas are used for crops and pasture. This soil is generally unsuitable for crop production. Crop yields during most seasons are limited by the low available water capacity. This soil is suited, however, to sprinkler irrigation. If irrigated, it is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability in this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of this soil as pasture or hayland is also effective in controlling erosion and soil blowing. Forage yields are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to trees. Poor seedling survival rates in dry years can be offset by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration or the establishment of plantings, can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is moderately suited to dwellings with or without basements and to local roads and streets because of the slope. The slope problem for all of these uses can be overcome by reducing the slope by cutting or cutting and adding fill material. Local roads and streets can also be constructed on the contour.

This soil is in capability unit VIs-4 and woodland suitability subclass 3s.

RuD—Rubicon sand, 12 to 20 percent slopes. This moderately steep, excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 50 acres in size.

Typically, the surface layer is very dark gray sand about 2 inches thick. The subsurface layer is grayish brown, loose sand about 2 inches thick. The subsoil is about 20 inches thick. It is dark reddish brown, very friable sand in the upper part; dark brown, loose sand in the middle; and strong brown, loose sand in the lower part. The substratum, to a depth of about 60 inches, reddish yellow, loose sand.

Included with this soil in mapping are small areas of Cromwell soils. The somewhat excessively drained Cromwell soils are similar to the Rubicon soil in position on the landscape but have a 12- to 24-inch-thick sandy loam mantle. Other inclusions are small sloping areas and severely eroded areas of Rubicon sand and small areas with slopes greater than 20 percent. Also included are some areas that are very stony. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in this Rubicon soil. The available water capacity is low, and surface runoff from cultivated areas is rapid. Organic matter content of the surface layer is low.

Most areas are in native woodland, and some areas have been planted to pine trees. A few small areas are used for crops. Because of the low available water capacity, the severe hazard of erosion, and the soil blowing hazard, this soil is unsuitable for cultivated crops.

Use of this soil as pasture or hayland is effective in controlling erosion and soil blowing, but forage yields are generally low because of the low available water capacity. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to trees. Erosion can be controlled by planting trees on the contour and careful location of skid roads during harvest. Poor seedling survival rates in dry years can be offset by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration or the establishment of plantings, can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the slope. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is poorly suited to dwellings with or without basements and to local roads and streets because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. Local roads and streets can also be constructed on the contour.

This soil is in capability unit VIIs-4 and woodland suitability subclass 3s.

SaA—Salter Variant very fine sandy loam 0 to 2 percent slopes. This nearly level, moderately well drained soil is on flats. Most areas are irregular in shape and range from about 3 to 150 acres in size.

Typically, the surface layer is very dark grayish brown very fine sandy loam about 8 inches thick. The subsurface layer is mostly brown, very friable very fine sandy loam about 8 inches thick. The subsoil is about 19 inches thick. It is dark brown and dark yellowish brown, friable and very friable, very fine sandy loam that is mottled in the lower part. The substratum, to a depth of about 60 inches, is light yellowish brown, mottled, very friable, stratified silt loam, very fine sand, and silt. In some places the surface layer is silt loam, loam, or fine sandy loam.

Included with this soil in mapping are small areas of Rousseau and Shiocton soils. The somewhat poorly drained Shiocton soils are lower than the Salter Variant soil in position on the landscape and are in drainageways and depressions and along the edges of wet bottom lands. The moderately well drained Rousseau soils are similar to the Salter Variant soil in position on the landscape but are sandy throughout. Also included are gently sloping areas and some areas of this soil where most of the subsoil is clay loam. These inclusions make up about 5 to 10 percent of the unit.

Permeability is moderate in this Salter Variant soil. The available water capacity is high. Surface runoff is slow. The water table is at depths as shallow as 3 feet during wet seasons. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

This soil is suited to pasture and hayland. Overgrazing, however, leads to a loss of plant cover and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table. This problem can be overcome by building a filtering mound of suitable material. This soil is suited to dwellings without basements. It is moderately suited to dwellings with basements because of the seasonal water table. This problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet or by constructing the basement above the level of wetness. This soil is moderately suited to local roads and streets because of the moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit I-1 and woodland suitability subclass 2o.

SaB—Salter Variant very fine sandy loam, 2 to 6 percent slopes. This gently sloping, moderately 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 very fine sandy loam about 8 inches thick. The subsurface layer is mostly brown, very friable very fine sandy loam about 4 inches thick. The subsoil is about 19 inches thick. It is dark brown and dark yellowish brown, friable and very friable, very fine sandy loam that is mottled in the lower part. The substratum, to a depth of about 60 inches, is light yellowish brown, mottled, very friable, stratified silt loam, very fine sand, and silt. Some areas are eroded. In some places the surface layer is silt loam, loam, or fine sandy loam.

Included with this soil in mapping are small areas of Rousseau and Shiocton soils. The somewhat poorly drained Shiocton soils are lower than the Salter Variant soil in position on the landscape and are in drainageways and depressions and along the edges of wet bottoms. The moderately well drained Rousseau soils are similar to the Salter Variant soil in position on the landscape but are sandy throughout. Other inclusions are small nearly level areas, sloping areas, and severely eroded areas of Salter Variant very fine sandy loam. Also included are some areas of this soil where most of the subsoil is clay loam. These inclusions make up about 5 to 10 percent of the unit.

Permeability is moderate in this Salter Variant soil. The available water capacity is high. Surface runoff from cultivated areas is medium. The water table is at depths as shallow as 3 feet during wet seasons. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled.

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a slight or moderate hazard of erosion. Erosion can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, contour stripcropping, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture and hayland, erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and results in erosion. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table. This problem can be overcome by building a filtering mound of suitable material. This soil is suited to dwellings without basements. It is moderately suited to dwellings with basements because of the seasonal high water table. This problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet or by constructing the basement above the level of wetness. This soil is moderately suited to local roads and streets because of the moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIe-1 and woodland suitability subclass 2o.

SaC—Salter Variant very fine sandy loam, 6 to 12 percent slopes. This sloping, well drained soil is on convex side slopes. Most areas are oblong in shape and range from about 3 to 100 acres in size.

Typically, the surface layer is dark brown very fine sandy loam about 7 inches thick. The subsurface layer is mostly brown, very friable, very fine sandy loam about 3 inches thick. The subsoil is dark brown, friable, very fine sandy loam about 17 inches thick. The substratum, to a depth of about 60 inches, is light yellowish brown, very friable, stratified silt loam, very fine sand, and silt. Some areas of this soil are eroded. In some places the surface layer is silt loam, loam, or fine sandy loam. In some places there are no free carbonates in the substratum.

Included with this soil in mapping are small areas of Menominee and Shawano soils. The well drained Menominee soils are similar to the Salter Variant soil in position on the landscape but have a 20- to 40-inch-thick sandy mantle over loamy deposits. The excessively drained Shawano soils are in similar landscape positions but are sandy throughout. Other inclusions are small gently sloping areas and severely eroded areas of Salter Variant very fine sandy loam and small areas with slopes greater than 12 percent. Also included are some areas of this soil where most of the subsoil is clay loam. These inclusions make up about 5 to 10 percent of the unit.

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

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated there is a moderate hazard of erosion. Erosion can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, contour stripcropping, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

The use of this soil for hayland or pasture is also effective in controlling erosion. Overgrazing, however, leads to a loss of plant cover and results in erosion. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material or by placing the absorption field on the contour. This soil is moderately suited to dwellings with or without basements because of the slope. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil is moderately suited to local roads and streets because of the moderate potential for frost action and the slope. The frost problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel. The slope problem can be overcome by shaping the land by cutting or cutting and adding fill material or by constructing roads on the contour.

This soil is in capability unit IIIe-1 and woodland suitability subclass 2o.

Sb—Saprists, ponded. These nearly level, very poorly drained soils are along the edges of open bodies of water and in depressions. They are ponded all or most of the year and are subject to flooding. Most areas are oblong or rounded in shape and range from about 3 to 200 acres in size.

Typically, these soils have an organic layer ranging from 16 to more than 51 inches in thickness. The substratum below the organic layer is sandy, loamy, or silty mineral soil. In some small areas the organic layer is less than 16 inches thick.

Permeability is moderately rapid, and available water capacity is very high. Surface runoff is ponded. These soils have a water table above the surface much of the year. Except for wetland plants, the depth of root penetration is limited by the water table.

Most areas are used for wetland wildlife habitat. These soils are unsuitable for cultivated crops, hay, and pasture because of their ponded condition. It is not feasible to drain most areas. These soils are not suited to woodland because they do not support trees. Good land use may include management of cover for wetland wildlife habitat.

These soils generally are unsuited to septic tank filter fields, dwellings with or without basements, and local roads and streets because of their flooded condition. Other sites on more suitable soils should be selected for these uses.

These soils are in capability unit VIIIw-15. They are not assigned to a woodland suitability subclass.

ScA—Scott Lake loam, 0 to 3 percent slopes. This nearly level and gently sloping, moderately well drained soil is on flats and foot slopes or in drainageways and depressions. Most areas are irregular in shape and range from about 3 to 150 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer is mostly brown, friable loam about 6 inches thick. The subsoil is about 16 inches thick. It is mostly dark brown, friable loam in the upper part; dark brown, mottled, friable loam in the middle; and dark brown, mottled, very friable sandy loam in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, loose gravelly loamy sand and gravelly coarse sand with thin strata of sand. In some places the surface layer is silt loam, and some areas have slopes slightly greater than 3 percent.

Included with this soil in mapping are small areas of Oesterle and Rosholt soils. The well drained Rosholt soils are similar to, or slightly higher than, the Scott Lake soil in position on the landscape. The somewhat poorly drained Oesterle soils are in slightly lower landscape positions in drainageways and depressions. Also included are some areas of Scott Lake loam that are very stony. These inclusions make up 5 to 10 percent of the unit.

In this Scott Lake soil the permeability is moderate in the subsoil and very rapid in the substratum. The available water capacity is moderate, and surface runoff is slow. The water table is at depths as shallow as 3 feet during wet seasons. Depth of root penetration is limited by the underlying sand and gravel. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and is easily tilled.

Most areas of this soil are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to grasses and legumes for hay and pasture. Erosion is generally not a problem on this soil. Regular additions of organic matter help maintain fertility and good tilth and increase water infiltration.

This soil is suited to pasture and hayland. Overgrazing, however, leads to a loss of plant cover and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and the very rapid permeability in the substratum. These problems can be overcome by building a filtering mound of suitable material. This soil is suited to dwellings without basements. It is moderately suited to dwellings with basements because of the seasonal water table. This problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet or by constructing the basement level above the level of wetness. This soil is moderately suited to local roads and streets because of the moderate potential for frost action. This problem can be overcome by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIs-1 and woodland suitability subclass 2o.

Sd—Seelyeville muck. This nearly level, very poorly drained soil is on low-lying flats and in drainageways and depressions. Most areas are irregular in shape, range from about 3 to 550 acres in size, and are subject to ponding.

Typically, the organic layer is more than 60 inches thick and is very dark brown muck in the upper part and is black, very dark grayish brown, and dark brown muck in the lower part. Some areas have more than 10 inches of mucky peat below the surface layer. In some places the muck has developed primarily from woody plants and contains woody fragments.

Included with this soil in mapping are small areas of Cathro, Loxley, and Markey soils. The very poorly drained Cathro and Markey soils are similar to the Seelyeville soil in position on the landscape but have an organic layer less than 51 inches thick. The very poorly drained Loxley soils are in similar landscape positions but are extremely acid to strongly acid. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Seelyeville soil. The available water capacity is very high, and surface runoff is very slow or ponded. Unless this soil is drained, the water table is above or near the surface throughout the year. This limits the depth of root penetration. Where this soil is drained, the organic matter decomposes and subsidence will occur.

Most areas of this soil are undrained and are in woodland. Some of the areas are used as unimproved pasture. This soil generally is unsuited to cultivated crops and pasture because the growing season is limited by frosts late in spring and early in fall. Drained areas of this soil are subject to burning, and cultivated areas are subject to soil blowing. Excessive lowering of the water table in this soil will increase subsidence.

Because of the high water table, periodic ponding, and low fertility, undrained areas of this soil are unsuitable for growing most forage species. Reed canarygrass is the only adapted species. In drained areas certain legumes such as red clover can be grown, but the low strength of this soil restricts the use of machinery and limits livestock grazing.

This soil is suited to trees. Soil wetness and the high water table during the tree planting season limits reforestation to natural regeneration. Harvesting with heavy equipment is limited to when the soil is frozen. Harvesting by clear-cut or area-selection methods will help reduce windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by the use of suitable herbicides or mechanical removal.

This soil is generally unsuited to septic tank absorption fields because of ponding. It is generally unsuited to dwellings with or without basements because it is subject to ponding and because it lacks sufficient strength to support building foundations. This soil is generally unsuited to local roads and streets because of ponding and the high potential for frost action. These problems are difficult to overcome for these uses, and perhaps the simplest alternative would be to select a different site on a more suitable soil.

This soil is in capability unit VIw-9, undrained. It is in woodland suitability subclass 3w.

SfB—Shawano loamy fine sand, 1 to 6 percent slopes. This nearly level and gently sloping, 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 fine sand about 8 inches thick. The subsoil is about 26 inches thick. It is strong brown, very friable and loose fine sand. The substratum, to a depth of about 60 inches, is reddish yellow, loose fine sand. Some small areas are eroded, and some have slopes of less than 1 percent. In some places the surface layer is fine sand. In some areas there are thin loamy sand bands in the substratum and in some the soil is less than 50 percent fine sand throughout.

Included with this soil in mapping are small areas of Menominee, Rousseau, and Wainola soils. The well drained Menominee soils are similar to the Shawano soil in position on the landscape but have a 20- to 40-inch-thick sandy mantle over loamy deposits. The moderately well drained Rousseau soils are in slightly lower landscape positions. The somewhat poorly drained Wainola soils are in lower landscape positions in drainageways and depressions. Also included are small sloping areas and severely eroded areas of Shawano loamy fine sand. These inclusions make up 10 to 15 percent of the unit.

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

Many areas are used for crops and pasture. Some areas are in native woodland, and some areas have been planted to pine trees. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture, but crop yields are generally limited by the low available water capacity. This soil is suited to sprinkler irrigation. If irrigated, this soil can produce better and more consistent yields. Where this soil is cultivated, there is a slight hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability in this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of this soil as pasture or hayland is also effective in controlling soil blowing. Yields are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to trees. Poor seedling survival in dry years can be offset by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration or the establishment of plantings, can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is suited to dwellings with or without basements and to local roads and streets.

This soil is in capability unit IVs-3 and woodland suitability subclass 2s.

SfC—Shawano loamy fine sand, 6 to 12 percent slopes. This sloping, excessively drained soil is on convex side slopes. Most areas are irregular in shape and range from about 3 to 200 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 4 inches thick. The subsoil is about 30 inches thick. It is strong brown, very friable and loose fine sand in the upper part and reddish yellow, loose fine sand in the lower part. The substratum, to a depth of about 60 inches, is light brown, loose fine sand. Some small areas are eroded. In some places the surface layer is fine sand. In some areas there are thin loamy sand bands in the substratum, and in some the soil is less than 50 percent fine sand throughout.

Included with this soil in mapping are small areas of Menominee soils. The well drained Menominee soils are similar to the Shawano soils in position on the landscape but have a 20- to 40-inch-thick sandy mantle over loamy deposits. Also included are small gently sloping, moderately steep, and severely eroded areas of Shawano loamy fine sand. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in this Shawano soil. The available water capacity is low, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is low or very low. The surface layer is very friable and can be easily tilled.

Some areas are used for crops and pasture. Some areas are in native woodland, and some have been planted to pine trees. This soil is poorly suited to crop production. Crop yields during most seasons are limited by the low available water capacity. This soil is suited, however, to sprinkler irrigation. If irrigated, it is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Fertilization, irrigation, and protection from soil blowing are necessary for dependable crop production. Because of the rapid permeability in this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of this soil as pasture or hayland is also effective in controlling erosion and soil blowing. Forage yields are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to trees. Poor seedling survival rates in dry years can be offset by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration or the establishment of plantings, can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in danger of pollution of the ground water. This soil is moderately suited to dwellings with or without basements and to local roads and streets because of the slope. The slope problem for all of these uses can be overcome by reducing the slope by cutting or cutting and adding fill material. Local roads and streets can also be constructed on the contour.

This soil is in capability unit IVs-3 and woodland suitability subclass 2s.

SfD—Shawano loamy fine sand, 12 to 20 percent slopes. This moderately steep, 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 loamy fine sand about 2 inches thick. The subsurface layer, about 2 inches thick, is brown, very friable fine sand. The subsoil is about 22 inches thick. It is brown, very friable fine sand in the upper part and strong brown, very friable and loose fine sand in the lower part. The substratum, to a depth of about 60 inches, is reddish yellow, loose fine sand. Some small areas are eroded. In some places the surface layer is fine sand. In some areas there are thin loamy sand bands in the substratum, and in some the soil is less than 50 percent fine sand throughout.

Included with this soil in mapping are small areas of Menominee soils. The well drained Menominee soils are similar to the Shawano soil in position on the landscape but have a 20- to 40-inch-thick sandy mantle over loamy deposits. Also included are small sloping areas and severely eroded areas of Shawano loamy fine sand and small areas of this soil with slopes greater than 20 percent. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in this Shawano soil. The available water capacity is low, and surface runoff from cultivated areas is rapid. Organic matter content of the surface layer is low or very low.

Most areas are in native woodland, and some areas have been planted to pine trees. A few small areas are in cropland, mainly as part of larger, less sloping units. Because of the low available water capacity, severe hazard of erosion, and soil blowing hazard, this soil is generally unsuitable for cultivated crops.

Use of this soil as pasture or hayland is effective in controlling erosion, but forage yields are generally low because of the low available water capacity. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive. Overgrazing leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help maintain plant cover.

This soil is suited to trees. Erosion can be controlled by planting trees on the contour and by careful location of skid roads during harvest. Poor seedling survival rates in dry years can be offset by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration or the establishment of plantings, can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the slope. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material. The soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is poorly suited to dwellings with or without basements and to local roads and streets because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. Local roads and streets can also be constructed on the contour.

This soil is in capability unit VIe-13 and woodland suitability subclass 2s.

SgB—Shawano-Briggsville complex, 2 to 6 percent slopes. This unit consists of gently sloping, excessively drained Shawano soil and well drained Briggsville soil on convex side slopes. Most areas of this unit are irregular in shape and range from 3 to 70 acres in size. Individual areas are 60 to 80 percent Shawano soil and 15 to 30 percent Briggsville soil. Areas of these two soils occupy similar landscape positions and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Shawano soil has a dark brown, loamy fine sand surface layer about 8 inches thick. The subsoil is strong brown, very friable fine sand about 26 inches thick. The substratum, to a depth of about 60 inches, is reddish yellow, loose fine sand. In some places the surface layer is fine sand or very fine sand.

Typically, the Briggsville soil has a dark brown, silt loam surface layer about 8 inches thick. The subsoil is reddish brown, firm silty clay and silty clay loam about 28 inches thick. The substratum, to a depth of about 60 inches, is reddish brown, firm silty clay loam. In some places the substratum has strata of silty loam and silty clay.

Included with this unit in mapping are small areas of Manawa, Menominee, and Rousseau soils. The somewhat poorly drained Manawa soils are lower than the Shawano and Briggsville soils in position on the landscape and are in depressions and drainageways. The moderately well drained Rousseau soils are slightly lower in the landscape. The well drained Menominee soils are similar to the Shawano and Briggsville soils in position on the landscape but have 20 to 40 inches of sandy deposits over loamy deposits. These inclusions make up 10 to 15 percent of the unit.

Permeability is rapid in the Shawano soil. The available water capacity is low, and surface runoff from cultivated areas is slow. Organic matter content of the surface layer is low or very low.

Permeability is moderately slow in the Briggsville soil. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate.

Most of this unit is in crops or pasture. These soils are suited to corn and small grains and to grasses and legumes for hay and pasture. If these soils are cultivated, there is a slight or moderate hazard of erosion and the Shawano soil is subject to soil blowing. Irrigation will increase yields but will also increase the erosion hazard. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways.

The use of these soils as pasture or hayland is also effective in controlling soil blowing and erosion. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

These soils are suited to trees. Seedling survival rates on the Shawano soil can be improved by careful planting of vigorous nursery stock. Competing vegetation interferes with natural regeneration following harvest, but it can be controlled by the use of suitable herbicides or mechanical removal.

The Shawano soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of ground water pollution. The Briggsville soil is poorly suited to septic tank absorption fields because of moderately slow permeability. This problem can be overcome by building a filtering mound of suitable material or by increasing the size of the absorption field. Shawano soil is suited to dwellings with or without basements and to local roads and streets. Briggsville soil is moderately suited to dwellings with or without basements because it lacks sufficient stability to adequately support building foundations. This problem can be overcome by replacing the soil with a coarse material such as sand or gravel under the footings and concrete slab. Briggsville soil is poorly suited to local roads and streets because it lacks sufficient strength to support vehicular traffic. This problem can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

These soils are in capability unit IVs-3. The Shawano soil is in woodland suitability subclass 2s. The Briggsville soil is in 2o.

SgC—Shawano-Briggsville complex, 6 to 12 percent slopes. This unit consists of sloping, excessively drained Shawano soil and well drained Briggsville soil on convex side slopes. Most areas of this unit are irregular in shape and range from about 3 to 150 acres in size. Individual areas are 60 to 80 percent Shawano soil and 15 to 30 percent Briggsville soil. Areas of these two soils occupy similar landscape positions and are so intricately mixed, or so small in size, that it was not practical to separate them in mapping.

Typically, the Shawano soil has a dark brown, loamy fine sand surface layer about 7 inches thick. The subsoil is strong brown, very friable fine sand about 23 inches thick. The substratum, to a depth of about 60 inches, is reddish yellow, loose fine sand. In some places the surface layer is fine sand or very fine sand.

Typically, the Briggsville soil has a dark brown, silt loam surface layer about 8 inches thick. The subsoil is reddish brown, firm silty clay and silty clay loam about 28 inches thick. The substratum, to a depth of about 60 inches, is reddish brown, firm silty clay loam. In some areas the surface layer is sandy loam or loam.

Included with this unit in mapping are small gently sloping areas and severely eroded areas and small areas with slopes greater than 12 percent. Also included are small areas that have 20 to 40 inches of sand over clayey deposits and small areas where the Briggsville soil is underlain by sand at depths of 20 to 40 inches. These inclusions make up 10 to 15 percent of the unit.

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

Permeability is moderately slow in the Briggsville soil. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate.

Most of this unit is in crops and pasture. These soils are suited to corn and small grains and to grasses and legumes for hay and pasture. If these soils are cultivated, there is a moderate hazard of erosion and the Shawano soil is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways.

The use of these soils as pasture or hayland is also effective in controlling soil blowing and erosion. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

These soils are suited to trees. Seedling survival rates on Shawano soil can be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by the use of suitable herbicides or mechanical removal.

The Shawano soil is poorly suited to septic tank absorption fields because of the rapid permeability. Septic tank absorption fields will function satisfactorily, but there is a danger of ground water pollution. The Briggsville soil is poorly suited to septic tank absorption fields because of the moderately slow permeability. This problem can be overcome by building a filtering mound of suitable material or by increasing the size of the absorption field. Shawano soil is moderately suited to dwellings with or without basements and local roads and streets because of slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. Briggsville soil is moderately suited to dwellings with or without basements because of the slope and because it lacks sufficient stability to support foundations. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material and by replacing the soil with a coarse material such as sand or gravel under the footings and concrete slab. Briggsville soil is poorly suited to local roads and streets because it lacks sufficient strength to adequately support vehicular traffic. This problem can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

These soils are in capability unit IVs-3. The Shawano soil is in woodland suitability subclass 2s. The Briggsville soil is in 2o.

ShA—Shiocton silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on low-lying flats, in drainageways and depressions, and on concave foot slopes. Some areas of this soil are subject to flooding. Most areas are irregular in shape and range from about 3 to 1,800 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsoil is about 16 inches thick. It is brown, mottled, friable silt loam in the upper part and brown, very friable very fine sandy loam in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, very friable very fine sandy loam in the upper part and multicolored, very friable, stratified silt loam and very fine sand in the lower part. In some places the surface layer is fine sandy loam. Some areas have slopes slightly greater than 3 percent.

Included with this soil in mapping are small areas of Bach, Iosco, and Salter Variant soils. The poorly drained and very poorly drained Bach soils are lower than the Shiocton soil in position on the landscape. The somewhat poorly drained Iosco soils are similar to the Shiocton soil in position on the landscape but have a 20- to 40-inch-thick sandy mantle over stratified lacustrine material. The well drained and moderately well drained Salter Variant soils are on higher landscape positions. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderate in this Shiocton soil. The available water capacity is high, and surface runoff is slow. Unless this soil is drained, the water table is at a depth of 1 to 3 feet during wet seasons. This limits the depth of root penetration during wet periods of the growing season. Organic matter content of the surface layer is high. The surface layer is very friable and easily tilled.

Most areas are used for crops and pasture. Some areas are in woodland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage of this soil. Where tile lines are placed in the underlying stratified deposits, loose sand can enter the tile line unless the tiles are covered with a suitable filter. Unless protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks will cave and plug the ditch.

Where drained, this soil is suited to pasture and hayland. Erosion is generally not a problem. Overgrazing, however, leads to a loss of plant cover and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction and results in poor tilth and reduced water infiltration. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and plant cover in good condition.

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

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and, in some areas, the flooding. Where the water table is at a depth of more than 2 feet and the soil is not subject to flooding the water table problem can be overcome by building a filtering mound of suitable material. It may also be possible to pump the effluent to an absorption field located on higher, more suitable soils. Where this soil is on a flood plain it should not be used for absorption fields, and a different site should be selected off the flood plain. This soil is poorly suited to dwellings with or without basements because of the seasonal high water table and, in some areas, the flooding. The seasonal high water table problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet and by raising the site elevation by adding fill material. Where this soil is on a flood plain it should not be used for dwellings, and a different site should be selected off the flood plain. This soil is poorly suited to local roads and streets because of the high potential for frost action and flooding. The frost problem can be overcome by subsurface drainage of the roadbed and by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel. The flooding problem can be overcome by using fill material to construct roads above the flooding level and by constructing stable overflow sections by having dips in the road covered with a strong concrete cover and riprap on the sides of the road. Larger bridges and culverts will permit floodwater to drain away.

This soil is in capability unit IIw-4 and woodland suitability subclass 2o.

SkA—Shiocton Variant silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on low-lying flats, in drainageways and depressions, and on concave foot slopes. Some areas are subject to flooding. Most areas are irregular in shape and range from about 3 to 70 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsoil is about 14 inches thick. It is brown, mottled, friable silt loam in the upper part and brown, mottled, friable very fine sandy loam in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, friable cobbly silt loam and cobbly loam. In some places the surface layer is loam. In some small areas there are no cobbles in the substratum and in some areas there is dolomite bedrock below a depth of 40 inches.

Included with this soil in mapping are small areas of Angelica soils and Onaway, cobbly substratum, soils. The poorly drained and very poorly drained Angelica soils are slightly lower than the Shiocton Variant soil in position on the landscape and have a few cobbles in the substratum. The well drained Onaway, cobbly substratum, soils are in higher landscape positions. Also included are some small areas of this soil that are poorly drained. These inclusions make up about 5 to 10 percent of the unit.

Permeability is moderate in this Shiocton Variant soil. The available water capacity is high, and surface runoff is slow. Unless this soil is drained, the water table is at a depth of 1 to 3 feet during wet periods. This limits the depth of root penetration during wet periods of the growing season. Organic matter content of the surface layer is moderate. The surface layer is friable and is easily tilled.

Drained areas of this soil are used as cropland and pasture. Undrained areas provide wildlife habitat, and some are used for unimproved pastureland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage of this soil, but cobbles in the substratum hinder excavations for ditch or tile drains. Unless protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks will cave and plug the ditch. Regular additions of organic matter help to maintain fertility and good tilth.

Where drained, this soil is suited to legumes and grasses for hay and pasture. Overgrazing leads to a loss of plant cover and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction and results in poor tilth and reduced water infiltration. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table. Where the water table is at a depth of more than 2 feet this problem can be overcome by building a filtering mound of suitable material. This soil is poorly suited to dwellings with or without basements because of the seasonal high water table and flooding. The water table problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet and by adding fill material to raise the site elevation. Diversions and dikes can be installed to protect the site from flooding. The soil is poorly suited to local roads and streets because of the high potential for frost action. This problem can be overcome by draining the roadbed by subsurface drainage and by covering or replacing the upper part of the soil with a coarse base material such as sand and gravel.

This soil is in capability unit IIw-2 and woodland suitability subclass 2o.

SoA—Solona loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on low-lying flats, in depressions and drainageways, and on concave foot slopes. Many areas are subject to flooding. Most areas are irregular in shape and range from about 3 to 9,850 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 18 inches thick. It is reddish brown, mottled, friable fine sandy loam in the upper part and reddish brown, mottled, friable fine sandy loam in the lower part. The substratum, to a depth of about 60 inches, is reddish brown, mottled, friable loam. In some places the surface layer is silt loam, sandy loam, or fine sandy loam. In some places the soil is formed in lacustrine deposits of stratified silt and very fine sand. In some small areas this soil is underlain by stratified sand and gravel below a depth of 40 inches.

Included with this soil in mapping are small areas of Angelica, Onaway, and Tilleda soils. The poorly drained and very poorly drained Angelica soils are lower than the Solona soil in position on the landscape and are in drainageways and depressions. The well drained and moderately well drained Onaway soils and well drained Tilleda soils are in higher landscape positions. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderate in this Solona soil. The available water capacity is high, and surface runoff is slow. Unless this soil is drained, the water table is at a depth of 1 to 3 feet during wet periods. This limits the depth of root penetration during wet periods of the growing season. Organic matter content of the surface layer is moderate. The surface layer is friable and easily tilled.

Drained areas of this soil are used as cropland and pasture. Undrained areas provide wildlife habitat, and some of these areas are used for unimproved pasture. Some areas are in woodland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage of this soil. Unless protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks will cave and plug the ditch. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where drained, this soil is suited to pasture and hayland. Overgrazing leads to a loss of plant cover, which encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction and results in poor tilth and reduces water infiltration. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table. Where the water table is at a depth of more than 2 feet this problem can be overcome by building a filtering mound of suitable material. This soil is poorly suited to dwellings with or without basements because of the seasonal high water table and flooding. These problems can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet and by adding fill material to raise the site elevation. Diversion and dikes can be installed to protect the site from flooding. This soil is poorly suited to local roads and streets because of the high potential for frost action (fig. 9). This problem can be overcome by subsurface drainage of the roadbed and by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

This soil is in capability unit IIw-2 and woodland suitability subclass 2o.

SyB—Solona-Onaway complex, 1 to 6 percent slopes. This unit consists of nearly level and gently sloping, somewhat poorly drained and moderately well drained soils in drainageways and depressions and on convex knolls. Most areas of this unit are irregular in shape and range from about 5 to 3,350 acres in size. Individual areas are 50 to 65 percent Solona soil and 25 to 45 percent Onaway soil. The Solona soil is subject to flooding and is in depressions and drainageways. The Onaway soil is on side slopes on convex knolls. Areas of these two soils are so intricately mixed, or so small in size, that it was not practical to separate them in mapping (fig. 10).

Typically, the Solona soil has a very dark grayish brown, loam surface layer about 9 inches thick. The subsoil is about 26 inches thick. It is mostly reddish brown, red, mottled, friable loam in the upper part and reddish brown, mottled, friable loam in the lower part. The substratum, to a depth of about 60 inches, is light reddish brown, mottled, friable loam. In some places the surface layer is silt loam, sandy loam, or fine sandy loam. In some small areas this soil formed in stratified silt and very fine sand. Some small areas are underlain by stratified sand and gravel below a depth of 40 inches.

Typically, the Onaway soil has a very dark grayish brown, fine sandy loam surface layer about 9 inches thick. The subsurface layer is brown, very friable fine sandy loam about 3 inches thick. The subsoil is about 16

Figure 9.—Blacktop road on somewhat poorly drained Solona soils breaking up during spring thaw as a result of frost heaving.

inches thick. It is mostly reddish brown, friable clay loam in the upper part; reddish brown mottled, friable clay loam in the middle; and reddish brown, mottled, friable loam in the lower part. The substratum, to a depth of about 60 inches, is reddish brown, mottled, friable loam. Some areas are eroded. In places the surface layer is silt loam or loam. In some small areas the soil formed in stratified silt and very fine sand.

Included with this unit in mapping are small areas of Angelica and Menominee soils. The poorly drained and very poorly drained Angelica soils are lower than the Solona and Onaway soils in position on the landscape and are in drainageways and depressions. The well drained Menominee soils are slightly higher than the Solona and Onaway soils in position on the landscape and have a 20- to 40-inch-thick sandy mantle. Also included are small severely eroded areas of Onaway soils and small areas with slopes greater than 6 percent. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderate in these Solona and Onaway soils. The available water capacity is high, and surface runoff from cultivated areas is slow on the Solona soil and medium on the Onaway soil. Unless drained, the Solona soil has a water table at a depth of 1 to 3 feet during wet seasons. This limits the depth of root penetration on the Solona soil during wet periods of the growing season. The Onaway soil has a water table at a depth of 3 to 5 feet during wet seasons. Organic matter content of the surface layer is moderate in the Solona soil and is moderately low or moderate in the Onaway soil. The surface layer on both soils is friable and easily tilled.

Most areas are used for crops and pasture. Where drained, these soils are suited to corn and small grains and to legumes and grasses for hay and pasture. If the Onaway soil is cultivated, there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage of the Solona soil. Unless protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks will cave and plug the ditch. Regular additions of organic matter help maintain fertility and good tilth and increase water infiltration.

Where drained, these soils are suited to pasture and hayland. Overgrazing leads to a loss of plant cover, which results in erosion and encourages undesirable plant species. Grazing when the surface layer is wet causes surface compaction and results in poor tilth and reduced water infiltration. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soils and the plant cover in good condition.

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

These soils are poorly suited to septic tank absorption fields because of the seasonal high water table. Where the water table is at a depth of more than 2 feet this problem can be overcome by building a filtering mound of suitable material. The Solona soil is poorly suited to dwellings with or without basements because of the seasonal high water table and flooding. The water table problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet and by adding fill material to raise the site elevation. Diversions and dikes can be installed to protect the site from flooding. Onaway soil is suited to dwellings without basements. It is moderately suited to dwellings with basements because of the seasonal high water table. This problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet or by constructing the basement

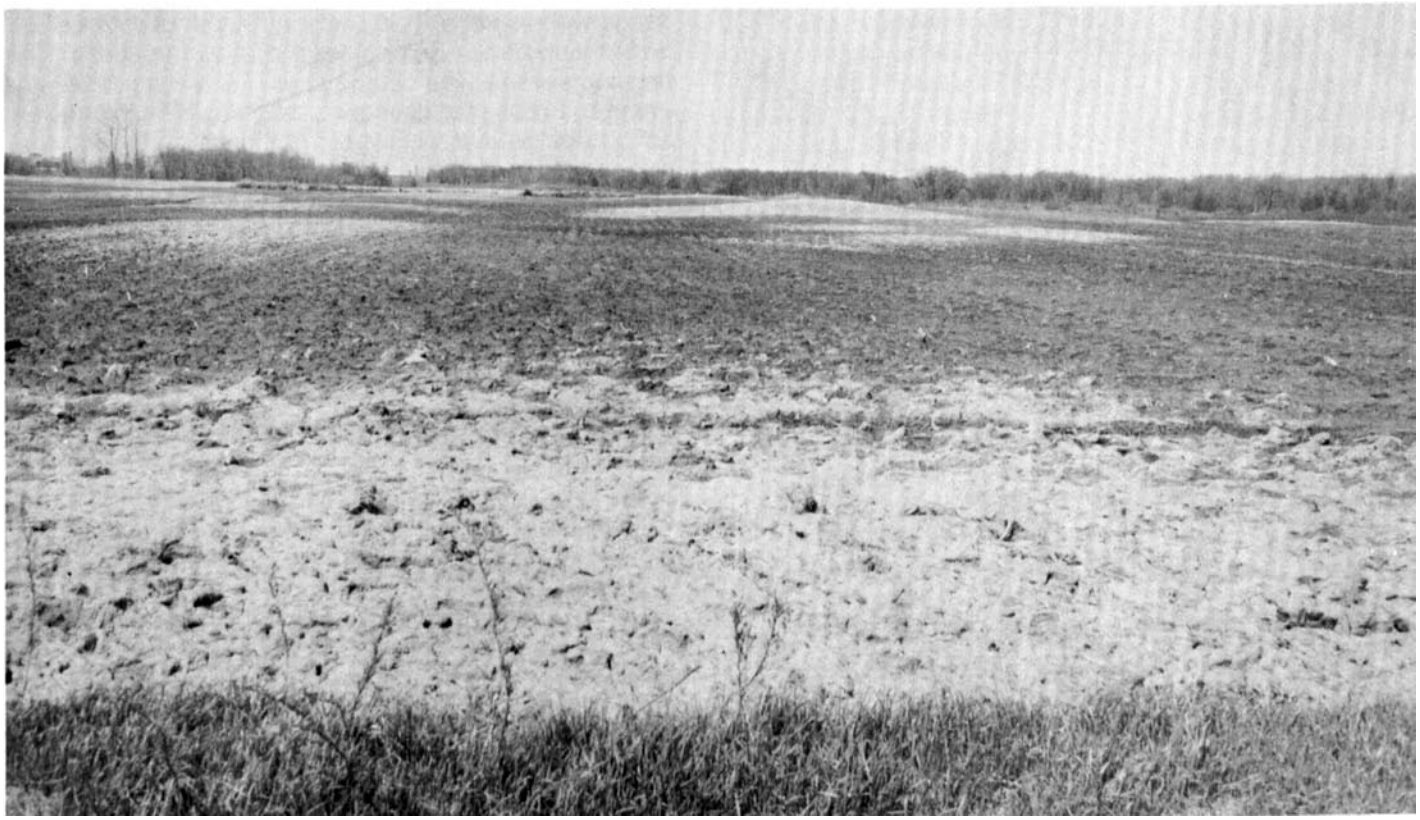

Figure 10.—Typical landscape of the Solona-Onaway complex. The lighter colored areas are the moderately well drained Onaway soil on low rises.

above the level of wetness. Solona soil is poorly suited to local roads and streets because of the high potential for frost action. Onaway soil is moderately suited to local roads and streets because of the moderate potential for frost action. The frost problem can be overcome by subsurface drainage of the roadbed and by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

These soils are in capability unit IIw-2 and woodland suitability subclass 2o.

TIB—Tilleda fine sandy loam, 1 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on flats and convex side slopes. Most areas are irregular in shape and range from about 3 to 1,300 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 7 inches thick. The upper part of the subsoil is dark brown, friable fine sandy loam about 2 inches thick. The next layer is mostly brown, friable fine sandy loam about 3 inches thick. The lower part of the subsoil is about 22 inches thick. It is mostly dark reddish brown, friable and firm loam. The substratum, to a depth of about 60 inches, is dark reddish brown, friable loam. In some places the surface layer is loamy sand, sandy loam, loam, or silt loam. Some small areas are eroded. In some places this soil is underlain by sand or sand and gravel below a depth of 20 inches.

Included with this soil in mapping are small areas of Menominee and Solona soils. The well drained Menominee soils are similar to the Tilleda soil in position on the landscape but have a 20- to 40-inch-thick sandy mantle. The somewhat poorly drained Solona soils are in lower areas in drainageways and depressions. Other inclusions are small sloping areas and severely eroded areas of Tilleda fine sandy loam and some small areas where the water table is at depths as shallow as 3 feet. Also included are some areas that are very stony. These inclusions make up 10 to 15 percent of the unit.

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

Most areas are used for crops and pasture. Some areas are in woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture and hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to growing trees (fig. 11). Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of the moderate permeability. This problem can be overcome by building a filtering mound of suitable material or by enlarging the absorption field. This soil is suited to dwellings with basements. It is moderately suited to dwellings without basements because it lacks sufficient stability to adequately support building foundations. This problem can be overcome by replacing the soil with a coarse material such as sand or

Figure 11.—Good stand of northern red oak in ungrazed woodland on the gently sloping Tilleda soils.

gravel under the footings and concrete slab. This soil is moderately suited to local roads and streets because of the moderate potential for frost action and because it lacks sufficient strength and stability to adequately support vehicular traffic. These problems can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

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

TlC2—Tilleda fine sandy loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes. Most areas are irregular in shape and range from 3 to 75 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. In most cultivated areas plowing has mixed in with the surface layer some dark reddish brown subsoil material. The subsoil is about 25 inches thick. It is mostly reddish brown, firm clay loam. The substratum, to a depth of about 60 inches, is reddish brown, friable loam. Some areas are uneroded. In some places the surface layer is loamy sand, sandy loam, loam, or silt loam. In some areas, this soil is underlain by sand or sand and gravel below a depth of 20 inches.

Included with this soil in mapping are small areas of Kennan and Menominee soils. The well drained Kennan soils are similar to the Tilleda soil in position on the landscape but have more sand and less silt and clay. The well drained Menominee soils are in similar landscape positions but have a 20- to 40-inch-thick sandy mantle. Also included are small gently sloping, moderately steep, and severely eroded areas of Tilleda fine sandy loam and some areas that are very stony. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderate in this Tilleda soil. The available water capacity is high, and surface runoff from cultivated areas is medium. Organic matter content of the surface layer is moderately low or moderate. The surface layer is difficult to till because of the firm, clay loam subsoil material that has been mixed in by plowing. It also tends to crust after heavy rains.

Most areas are used for crops and pasture. Some areas are in native woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a moderate hazard of further erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture and hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Grazing when the surface layer is wet causes surface compaction and results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration or the establishment of plantings, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of slope and the moderate permeability. These problems can be overcome by building a filtering mound of suitable material or by enlarging the absorption field and by reducing the slope by cutting or cutting and adding fill material. This soil is moderately suited to dwellings with or without basements because of the slope and for dwellings without basements because of insufficient stability to adequately support building foundations. These problems can be overcome by replacing the soil with a coarse material such as sand or gravel under the footings and concrete slab and by reducing the slope by cutting or cutting and adding fill material. This soil is moderately suited to local roads and streets because of slope, insufficient stability to adequately support vehicular traffic, and moderate potential for frost action. The slope problem can be overcome by reducing the slope by cutting or cutting and adding fill material or by constructing roads on the contour. The insufficient stability and frost problems can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

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

TlD—Tilleda fine sandy loam, 12 to 20 percent slopes. This moderately steep, well drained soil is on convex side slopes. Most areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is brown, friable loam about 5 inches thick. The subsoil is about 26 inches. It is mostly reddish brown, firm loam. The substratum, to a depth of about 60 inches, is reddish brown, friable loam. Some areas are eroded. In some places the surface layer is loamy sand, sandy loam, loam, or silt loam. In some places this soil is underlain by sand or sand and gravel below a depth of 20 inches.

Included with this soil in mapping are small areas of Kennan and Menominee soils. The well drained Kennan soils are similar to the Tilleda soil in position on the landscape but have more sand and less silt and clay.

The well drained Menominee soils are in similar landscape positions but have a 20- to 40-inch-thick sandy mantle. Other inclusions are small sloping areas and severely eroded areas of Tilleda fine sandy loam and some small areas with slopes greater than 20 percent. Also included are some areas that are very stony. These inclusions make up 10 to 15 percent of the unit.

Permeability is moderate in this Tilleda soil. The available water capacity is high, and surface runoff from cultivated areas is rapid. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and can be easily tilled.

Most areas are used for woodland. Some areas are in cropland and pasture. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a severe hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture and hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Grazing when the surface layer is wet causes surface compaction, which results in poor tilth and increases runoff and the hazard of erosion. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Soil-related problems of forest management are associated with steepness of slope or plant competition following harvest. Planting trees on the contour and careful location of skid roads during harvest will minimize erosion. Seedling survival rates on steeper slopes facing south or west may be improved by careful planting of vigorous nursery stock. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by the use of suitable herbicides or mechanical removal. Harvesting operations may expose sufficient mineral soil to allow adequate regeneration.

This soil is poorly suited to septic tank absorption fields because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material and by installing a trench absorption system on the contour. This soil is poorly suited to dwellings with or without basements and to local roads and streets because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. Local roads and streets can also be constructed on the contour.

This soil is in capability unit IVe-1 and woodland suitability subclass 1r.

TvB—Tilleda Variant fine sandy loam, 2 to 6 percent slopes. This gently sloping, well 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 grayish brown fine sandy loam about 9 inches thick. The subsurface layer is mostly light brownish gray, friable loam about 5 inches thick. The subsoil is about 22 inches thick. It is mostly reddish brown, friable loam in the upper part and is reddish brown, friable fine sandy loam in the lower part. The substratum, to a depth of about 60 inches, is light brown, loose, fine sand. Some areas of this soil are nearly level, and some are eroded. In some areas the loamy mantle is less than 20 inches thick, and in some it is more than 36 inches thick.

Included with this soil in mapping are small areas of Rosholt and Tilleda soils. The well drained Rosholt soils are similar to the Tilleda Variant soils in position on the landscape but have more sand and less clay in the subsoil. The well drained Tilleda soils are in similar landscape positions but have a loamy mantle more than 60 inches thick. Also included are some sloping areas of Tilleda Variant soils, some areas that are severely eroded, and some areas that are very stony. These inclusions make up 10 to 15 percent of the unit.

In this Tilleda Variant soil the permeability is moderate in the subsoil and rapid in the substratum. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying fine sand. Organic matter content of the surface layer is moderately low or moderate. The surface layer is friable and is easily tilled.

Most areas are used for crops and pasture. Some areas are in woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a slight or moderate hazard of erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture and hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, and controlled grazing help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration following harvest, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is suited to dwellings with basements. It is moderately suited to dwellings without basements because it lacks sufficient stability to adequately support foundations. This problem can be overcome by replacing the soil with a coarse material such as sand or gravel under the footings. It is moderately suited to local roads and streets because of the moderate potential for frost action and because it lacks sufficient strength and stability in the subsoil to adequately support vehicular traffic. All of these problems can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

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

TvC2—Tilleda Variant fine sandy loam, 6 to 12 percent slopes, eroded. This sloping, well drained soil is on convex side slopes. Most areas are irregular in shape and range from 3 to 35 acres in size.

Typically, the surface layer is dark reddish brown fine sandy loam about 7 inches thick. In most cultivated areas it contains some reddish brown subsoil material mixed in by plowing. The subsoil is about 26 inches thick. It is reddish brown, firm clay loam. The substratum, to a depth of about 60 inches, is reddish yellow, loose sand. Some areas are uneroded. In some areas the loamy mantle is less than 20 inches thick, and in some it is more than 36 inches thick.

Included with this soil in mapping are small areas of Rosholt and Tilleda soils. The well drained Rosholt soil is similar to the Tilleda Variant soil in position on the landscape but has more sand and less clay in the subsoil. The well drained Tilleda soils are in similar landscape positions but have a loamy mantle more than 60 inches thick. Also included are small gently sloping, severely eroded, and very stony areas of Tilleda Variant soils and small areas with slopes greater than 12 percent. These inclusions make up 10 to 15 percent of the unit.

In this Tilleda Variant soil the permeability is moderate in the subsoil and rapid in the substratum. The available water capacity is moderate, and surface runoff from cultivated areas is medium. Depth of root penetration is limited by the underlying sand. Organic matter content of the surface layer is moderately low or moderate. In eroded areas, the surface layer is more difficult to till because of the clay loam subsoil material that has been mixed in by plowing. It also tends to crust after heavy rains.

Most areas are used for crops and pasture. Some areas are in woodland. This soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Where this soil is cultivated, there is a moderate hazard of further erosion and it is subject to soil blowing. Erosion and soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, contour farming, wind and contour stripcropping, field windbreaks, diversions, and grassed waterways. Regular additions of organic matter help to maintain fertility and good tilth and increase water infiltration.

Where this soil is used as pasture or hayland, erosion and soil blowing are generally not problems. Overgrazing, however, leads to a loss of plant cover and results in erosion and soil blowing. Fertilization, renovation, controlled grazing, and restricted use during wet periods help to keep the soil and the plant cover in good condition.

This soil is suited to trees. Competing vegetation interferes with natural regeneration following harvest, but it can be controlled through the use of suitable herbicides or removed mechanically.

This soil is moderately suited to septic tank absorption fields because of the slope. This problem can be overcome by reducing the slope by cutting or cutting and adding fill material. This soil readily accepts the effluent from septic tank absorption fields but does not adequately filter it. This results in a danger of pollution of the ground water. This soil is moderately suited to dwellings with or without basements because of the slope. In addition, it is moderately suited to dwellings with basements because it lacks sufficient stability in the subsoil to adequately support foundations. The slope problem can be overcome by shaping the soil by cutting or cutting and adding fill material to get a suitable slope. The stability problem can be overcome by replacing the soil with a coarse material such as sand or gravel under the footings. This soil is moderately suited to local roads and streets because of the slope, the moderate potential for frost action, and the insufficient strength of the subsoil to adequately support vehicular traffic. The slope problem can be overcome by shaping the soil by cutting or cutting and adding fill material to get a suitable slope. The frost and strength problems can be overcome by strengthening the soil with lime or by covering or replacing the upper part of the soil with a coarse base material such as sand or gravel.

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

WaA—Wainola fine sand, 0 to 3 percent slopes. This nearly level and gently sloping, 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 3 to 800 acres in size.

Typically, the surface layer is black fine sand about 2 inches thick. The subsurface layer is brown, very friable fine sand about 3 inches thick. The subsoil is about 17 inches thick. It is dark brown, mottled, very friable fine sand in the upper part and strong brown, mottled, very friable fine sand in the lower part. The substratum, to a depth of about 60 inches, is brown, mottled, loose, stratified fine sand and very fine sand. In some places the surface layer is fine sandy loam or loamy fine sand.

Included with this soil in mapping are small areas of Cormant, Rousseau, and Shawano soils. The poorly and very poorly drained Cormant soils are in depressions and drainageways. The moderately well drained Rousseau and excessively drained Shawano soils occupy small knolls and ridges in this unit. These inclusions make up 5 to 10 percent of the unit.

Permeability is rapid in this Wainola soil. The available water capacity is low. Surface runoff is slow. Unless this soil is drained, the water table is at a depth of 1 to 3 feet during wet periods of the year. This limits the depth of root penetration during wet periods of the growing season. Organic matter content of the surface layer is low. This soil is very friable and easily tilled.

Drained areas are used for crops and pasture. Undrained areas provide wildlife habitat and some of these areas are used for unimproved pasture. Some areas are in woodland. Where drained, this soil is suited to corn and small grains and to legumes and grasses for hay and pasture. Surface drainage is used to remove excess surface water rapidly. Both deep ditch and tile drainage are used for internal drainage of this soil. Where tile drainage is used, loose sand will enter the tile lines unless the tile are covered with a suitable filter. Unless protected by plant cover, ditchbanks are easily eroded by flowing water. Vertical banks will cave and plug the ditch. Drained and cultivated areas of this soil are subject to soil blowing. Soil blowing can be reduced by proper management of crop residues, use of a conservation tillage system such as chisel planting that leaves a protective amount of crop residue on the soil surface, wind stripcropping, and field windbreaks. Where the water table is lowered excessively, crop yields during most seasons are limited by the low available water capacity. This soil is suited to sprinkler irrigation. Fertilization, irrigation, and controlled drainage are necessary for dependable crop production. Because of the rapid permeability of this soil, the irrigation rate should be limited to prevent washing plant nutrients out of the root zone.

Use of this soil as pasture or hayland is also effective in controlling soil blowing. With good management and adequate drainage, this soil is suited to pasture or hayland. Forage yields, however, are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

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

This soil is poorly suited to septic tank absorption fields because of the seasonal high water table and rapid permeability. Where the water table is at a depth of more than 2 feet these problems can be overcome by building a filtering mound of suitable material. This soil is poorly suited to dwellings with or without basements because of the high water table. This problem can be overcome by installing a subsurface drainage system with a gravity or other dependable outlet or by adding fill material to raise the site elevation. Basements can be constructed above the level of wetness. This soil is moderately suited to local roads and streets because of the high water table and moderate potential for frost action. These problems can be overcome by lowering the seasonal high water table by installing a subsurface drainage system, adding fill material to raise the roadbed above the wetness level, and increasing the subbase thickness using a coarse material such as sand or gravel.

This soil is in capability unit IVw-5 and woodland suitability subclass 1s.

Wh—Wheatley loamy fine sand. This nearly level, poorly drained and very poorly drained soil is on low-lying flats and in drainageways and depressions. Most areas are irregular in shape, range from about 3 to 1,100 acres in size, and are subject to ponding.

Typically, the surface layer is black loamy fine sand about 9 inches thick. The substratum, to a depth of about 60 inches, is light brownish gray, mottled, loose fine sand in the upper part; mixed, dark grayish brown and brown, mottled, loose, stratified loamy fine sand and fine sand in the middle; and gray, loose, stratified sand and gravel in the lower part. In some places the surface layer is loamy sand, mucky loamy sand, or mucky loamy fine sand. Some areas have an organic surface layer up to 16 inches thick.

Included with this soil in mapping are small areas of Au Gres Variant and Markey soils. The somewhat poorly drained Au Gres Variant soils are slightly higher than the Wheatley soil in position on the landscape. The very poorly drained Markey soils are in similar landscape positions but have a 16- to 51-inch-thick organic layer. These inclusions make up 5 to 10 percent of the unit.

Permeability is rapid in this Wheatley soil. The available water capacity is low. Surface runoff is very slow. Unless this soil is drained, the water table is above or near the surface throughout the year. This limits the depth of root penetration. Organic matter content of the surface layer is high or very high. The surface layer is very friable and can be easily tilled.

Most areas are undrained and are generally unsuited to crops. Undrained areas provide wildlife habitat, and some are used for unimproved pasture. A few areas have been drained and are used for corn and small grains and for legumes and grasses for hay and pasture. Drained and cultivated areas of this soil are subject to soil blowing.

Undrained areas of this soil are unsuitable for most forage species. Where drained, this soil is suited to growing certain grasses and legumes, but forage yields are generally low unless this soil is fertilized and irrigated. Planting early in spring, before the surface layer has a chance to dry, is best on this soil. Later plantings are less likely to survive unless they are irrigated. Overgrazing leads to a loss of plant cover and results in soil blowing. Fertilization, renovation, and controlled grazing help to maintain plant cover.

This soil is poorly suited to trees. Tree growth is so slow and form so poor that trees are barely merchantable at best. Soil wetness generally requires preparing ridges and planting by hand or machine if natural regeneration is unreliable. Use of large, vigorous nursery stock will reduce the mortality rate. Harvesting operations are frequently limited to when the soil is frozen. Harvest by clear-cut or area-selection methods will help reduce windthrow of the remaining trees. Competing vegetation, which interferes with natural regeneration following harvest, can be controlled by the use of suitable herbicides or mechanical removal.

This soil is generally unsuited to septic tank absorption fields because of ponding and rapid permeability in the substratum. This soil is generally unsuited to dwellings with or without basements because of ponding. These problems are difficult to overcome for these uses, and a more suitable site should be selected. This soil is poorly suited to local roads and streets because of ponding. This problem can be overcome by removing surface water through suitable outlets with ditches and culverts. Installing culverts can also help to prevent road damage by equalizing the water level on both sides of the road.

This soil is in capability unit VIw-6, undrained. It is in woodland suitability subclass 4w.

prime farmland

The best land for farming is called 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 providing the Nation's short- and long-range needs for food and fiber. Because the amount of this high quality farmland is limited, it should be used with wisdom and foresight.

Prime farmland is the land best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops where it is treated and managed with acceptable farming methods. Given minimal inputs of energy and economic resources, prime farmland produces higher yields and less damage to the environment than farming other kinds of land.

Prime farmland may now be cropland, pasture, woodland, or anything other than urban and built-up land or water areas. It must either be used for producing food or fiber or be available for these uses.

The soils that make up prime farmland usually have an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity is suitable. These soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope gradient is mostly less than 6 percent.

Soils that have limitations—such as a high water table, flooding, or inadequate rainfall—may qualify as prime farmland if these limitations are overcome by corrective measures. Onsite evaluation is necessary, however, to see if the corrective measures are effective. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

Nearly 35 percent of the land area of Shawano County, or 203,400 acres, is prime farmland. It is scattered throughout the county, but most is in map units 1,2,3, and 8 of the general soil map. Approximately 130,000 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 some parts of the county has been the conversion of prime farmland to industrial and urban uses. Such loss of prime farmland to nonfarm uses increases farming on marginal lands that are more erodible and droughty, are difficult to cultivate, and are usually less productive.

The detailed soil map units that make up the prime farmland in Shawano County and their total acreage are listed in table 4. Any corrective measures needed are indicated in parentheses. This list, however, is not a recommendation for a particular land use.

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 suitability 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 255,00 acres in Shawano County was used for crops and pasture in 1967 according to the Wisconsin Conservation Needs Inventory. Of this total, about 27,000 acres was used for permanent pasture; 48,000 acres for row crops, mainly corn; 45,000 acres for small grains, mainly oats; 88,000 acres for rotational hay and pasture; and 22,000 acres for permanent hay. The rest was idle cropland.

The potential of the soils in Shawano County for increased production of crops is good. About 169,000 acres of potentially good cropland is currently used for woodland and about 18,000 acres is used for pasture. In addition to the reserve capacity represented by this land, food production could also be increased considerably by extending better crop production technology to all parts of the county.

Erosion is the major soil problem on about 62 percent of the cropland and pasture in Shawano County. Where the slope is more than 2 percent, erosion is a hazard.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. This is especially damaging on soils that have a clayey subsoil, such as the Briggsville soils, and on soils that are only moderately deep over bedrock, such as the Fairport soils. Erosion also reduces productivity on soils that tend to be droughty, such as Menahga, Rubicon, and Shawano soils. Second, soil erosion on farmland results in sediment entering streams and decreasing the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion can generally be reduced by practices that provide protective surface cover, reduce runoff, and increase water infiltration. A cropping system that keeps plant cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce yields. On dairy farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land and also provide nitrogen and improve tilth for other crops grown in rotation.

Conservation tillage systems that leave protective amounts of crop residue on the surface, such as no-till, till plant, chisel planting, and disc planting, help to increase infiltration and reduce runoff and erosion. These systems can be adapted to most soils in the county, but are more difficult to use successfully on poorly drained soils.

Terraces and diversions reduce runoff and erosion by reducing the length of slope. Contour farming and stripcropping also shorten the slope and reduce runoff and erosion. Grassed waterways prevent erosion in channels and increase infiltration by slowing down the runoff.

Soil blowing is a hazard on the sandy Alban Variant, Au Gres, Au Gres Variant, Brevort, Cormant, Mahtomedi, Menahga, Menominee, Rousseau, Rubicon, Shawano, Wainola, and Wheatley soils and on the organic Cathro, Loxley, Markey, and Seelyeville soils. It is also a hazard on the Alban, Boyer, Cromwell, Fairport, Kennan, Lorenzo Variant, Salter Variant, Onaway, Rosholt, Tilleda, and Tilleda Variant soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining plant cover, surface mulching, wind stripcropping, and establishing field windbreaks minimize soil blowing on these soils.

Information on the design of erosion control practices best suited to each kind of soil can be obtained at the local office of the Soil Conservation Service.

Drainage is a major management need on about 17 percent of the acreage used for crops and pasture in the county. Some soils are so naturally wet that it is generally not possible for them to produce the crops common to the area unless they are drained. These are the poorly drained and very poorly drained soils such as Angelica, Bach, Brevort, Cormant, Fordum, Minocqua, and Wheatley soils. Also in this category are the organic soils such as Cathro, Loxley, Markey, and Seelyeville soils.

Unless artificially drained, the somewhat poorly drained soils are so wet that crops are damaged during most years. In this category are the Au Gres, Au Gres Variant, Iosco, Manawa, Oesterle, Plover, Shiocton, Shiocton Variant, Solona, and Wainola soils.

The most suitable design of both surface and subsurface drainage systems depends on the kind of soil and the site conditions. A combination of surface drainage and subsurface drainage is needed in most areas of the poorly drained and very poorly drained soils that are used for intensive row cropping. Diversions are needed in some areas to divert runoff from adjacent slopes.

If organic soils are used for cropland, controlled drainage is necessary. When water is removed, the pore spaces fill with air and the organic material oxidizes and subsides. To overcome this problem special drainage systems are needed to control the depth and the period of drainage. Keeping the water table at the level required for crops during the growing season and raising it to the surface during other parts of the year minimizes the oxidation and subsidence of organic soils.

Crops are subject to frost damage on most areas of poorly drained and very poorly drained soils because of their low position on the landscape. The number of frost-free growing days per season is less on these soils than on adjacent upland soils because of cold air drainage to the lowlands.

Information on the best drainage designs for each kind of soil can be obtained at the local office of the Soil Conservation Service.

Soil *fertility* is quite variable in the soils of Shawano County, depending on the cropping history. Nearly all of the soils in the western two-thirds of the county have been weathered very deep and are now acid. If they have never been limed, they require applications of ground limestone to raise the pH level sufficiently for good growth of alfalfa and other crops that grow best in nearly neutral soils. In general, coarse and moderately coarse soils require less lime than medium-textured soils. Available potash levels are naturally low in many soils of the county. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the desired level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil *tilth* is an important factor in the germination and emergence of seeds and in 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 on soils that have a loam or silt loam surface layer. Intense rainfall on bare soil can cause formation of a crust on the surface that reduces infiltration and increases runoff and erosion. Good soil tilth is more difficult to maintain on eroded soils because they have a lower content of organic matter. Returning crop residues and regularly adding manure or other organic material will improve soil structure and tilth and help prevent surface crusting.

Field crops suited to the soils and climate of the county include many that are not commonly grown. Corn is the common row crop and much of it is used for corn silage. Some sunflowers are also grown. Oats is the common small grain. Wheat, barley, and rye are grown in small amounts. Because of the predominance of dairying, hay is an important crop. Alfalfa-bromegrass is the dominant hay crop, but red clover, alsike clover, and timothy are also grown. Birdsfoot trefoil is well adapted to the wet soils in the county that are not sandy.

Special crops grown commercially in the survey area are vegetables and apples. The most common vegetables grown are sweet corn, yellow and green beans, peas, potatoes, and cabbage. A small acreage throughout the county is used for tomatoes, melons, strawberries, raspberries, squash, and many other vegetables.

Many of the soils in the county that have good natural drainage and warm up early in the spring are suited to a wide variety of vegetables and small fruits. Information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents (*3*). Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have 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.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-4.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

George W. Alley, forester, Soil Conservation Service, helped prepare this section.

Forest once covered all of the area that is now Shawano County. Many of the soils best suited to agriculture have since been cleared for cropland. Areas of intensive farming predominate in the eastern half of the county.

About 46 percent of the land area in the county, or about 270,000 acres, remains in commercial forest. A large part of this acreage is owned by farmers or other private owners. Smaller tracts are owned by forest industries or are in public ownership (*8*).

The largest and most important areas of woodland are in general soil map units 1, 2, and 3. The most important trees are sugar maple, basswood, northern red oak, aspen, and paper birch. In map units 4 and 5, in which the soils are dominantly sandy, a considerable acreage has been planted to pine trees. This is also true on a considerable acreage of the sandy and better drained minor soils in map unit 6.

Forest fires have been controlled, but removing the defective trees and less desirable species would improve the forest stands. There is also a need for excluding livestock from the woodlots that are grazed. Many of the pine plantations on sandy soils are now old 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 (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

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

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

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

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

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

Additional information about woodland management and productivity can be obtained from the Wisconsin Department of Natural Resources forester, the local office of the Soil Conservation Service, or the local office of 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, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 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 forester, or from a nursery.

recreation

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 soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Steve F. Baima, biologist, Soil Conservation Service, helped prepare this section.

Shawano County has a large and diverse population of fish and wildlife. Although it does not have as many lakes as those Wisconsin counties to the north and west, it does claim an extensive stream-trout fishery. Most of the streams are located in the western half of the county and support self-sustaining brook trout and brown trout populations.

Forest wildlife includes woodcock, deer, ruffed grouse, and bear, particularly in the western three-fourths of the county. Areas that are best suited to improvement of their habitat are in general soil map units 1 and 2. Additional deer browse is needed in hardwood swamps.

Mature sugar maple and basswood forests are replacing aspen forests in numerous upland areas. Forest and woodlot management aimed at aspen regeneration benefits forest wildlife and is a key management practice in the western half of the county.

The eastern half of the county, particularly the area within map unit 8, is extensively farmed. Species such as squirrel, fox, and numerous nongame birds would benefit greatly from woodlot preservation in this area. The area within map unit 8 also has potential for upland game bird management, particularly for pheasants and Hungarian partridge, but shortages of winter cover and undisturbed nesting cover are limiting factors.

The southeastern part of the county is important for wildlife. This area is characterized by sandy uplands and marshy depressions. It is best suited to forest and wetland wildlife management. Management on state-owned land in map unit 5 is oriented toward waterfowl, furbearers, deer, and grouse.

The populations of pileated woodpecker, greater sandhill crane, wood turtle, red-shouldered hawk, and Cooper's hawk are a concern in the county. These species are either uncommon, endangered, or threatened with extinction.

In general, wildlife is abundant in Shawano County because there is still a good interspersion of habitat and cover types. It will become increasingly important to wildlife to preserve the variety and distribution of wetlands and woodlots to balance habitat losses associated with agricultural development. Urban expansion and recreational development such as that around Shawano Lake are also a significant threat to wildlife habitat.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 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 fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, switchgrass, goldenrod, beggarweed, tickclover, 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, the available water capacity, and wetness. Examples of these plants are oak, aspen, poplar, cherry, maple, basswood, hawthorn, dogwood, blackberry, and blueberry.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, 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 Hungarian partridge, pheasant, meadowlark, bobolink, bluebird, field sparrow, 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 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, 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, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, 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 the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that 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 or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 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 or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts 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 excessive gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 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. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 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, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts, 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 or to a cemented pan 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. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil is more than 15 to 20 percent particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. 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.

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 earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

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 of soil to soil blowing and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control 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 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. 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 of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 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.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 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, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of no more than once in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 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 specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either dessication 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 is a result of drainage and 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 most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

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 typical of the series and are described in the section "Soil series and their morphology." The soil samples were tested by the Wisconsin Department of Transportation, Division of Highways, in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

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); 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 (*7*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *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 (*Glosso*, meaning tongued, plus *boralf*, the suborder of the Alfisols that have a cool temperature).

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 coarse-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. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*6*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*7*). 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."

Alban series

The Alban series consists of moderately well drained, moderately permeable soils on stream terraces and in basins of glacial lakes. These soils formed in stratified loamy lacustrine deposits. Slope ranges from 2 to 6 percent.

Alban soils are similar to Rosholt and Salter Variant soils and are adjacent to Plover and Rosholt soils on the landscape. Rosholt soils are similar to the Alban soils in position on the landscape but are well drained and are underlain by sand or sand and gravel. Salter Variant soils are underlain by calcareous, stratified loamy lacustrine deposits. Plover soils are somewhat poorly drained and occupy lower landscape positions in drainageways and depressions.

Typical pedon of Alban fine sandy loam, 2 to 6 percent slopes, approximately 1,450 feet south and 30 feet east of the northwest corner of sec. 30, T. 26 N., R. 15 E.

Ap—0 to 7 inches; dark brown (10YR 3/3) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate very fine subangular blocky structure; very friable; many roots; neutral; abrupt smooth boundary.

B&A—7 to 12 inches; reddish brown (5YR 4/4) fine sandy loam (B2t); moderate very fine subangular blocky structure; occupies about 60 percent of the horizon; thin patchy clay films on faces of peds (B2t); penetrated by tongues of brown (7.5YR 5/4) loamy fine sand (A2), light brown (7.5YR 6/4) dry; weak thin platy structure; very friable; many roots; slightly acid; clear irregular boundary.

B21t—12 to 24 inches; reddish brown (5YR 4/4) loam; moderate fine subangular blocky structure; friable; common roots; thin patchy clay films on faces of peds; slightly acid; clear wavy boundary.

B22t—24 to 31 inches; reddish brown (5YR 4/4) very fine sandy loam; moderate fine subangular blocky structure; friable; few roots; thin patchy clay films on faces of peds; medium acid; clear wavy boundary.

B3—31 to 38 inches; reddish brown (5YR 4/4) very fine sandy loam; weak medium subangular blocky structure; friable; few roots; thin patchy clay films on faces of a few peds; medium acid; gradual wavy boundary.

C—38 to 60 inches; reddish brown (5YR 5/4) very fine sandy loam; few medium prominent strong brown (7.5YR 5/8) mottles; weak medium platy structure; friable; few thin strata of very fine sand; medium acid.

Solum thickness ranges from 30 to 50 inches. Reaction ranges from strongly acid to neutral in the solum and from medium acid to neutral in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 4 inches thick with value of 2 or 3 and chroma of 1 or 2. Some pedons have an A2 horizon. Some pedons have an A&B horizon, some do not have a B&A horizon, and some have both. The A2 part of these horizons has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam. The Bt part of the A&B or B&A horizon is similar to the B2t horizon, which has hue of 5YR, 7.5YR, or 10YR; value of 4 to 6; and chroma of 3 to 6. It is loam, sandy loam, fine sandy loam, or very fine sandy loam. The C horizon has hue of 5YR to 10YR with value and chroma of 4 to 6.

Alban Variant

The Alban Variant consists of moderately well drained, rapidly over moderately permeable soils on outwash plains and in basins of glacial lakes. These soils formed in 20 to 36 inches of sandy deposits and the underlying acid loamy and sandy lacustrine deposits. Slope ranges from 2 to 6 percent.

Alban Variant soils are similar to Menominee soils and are adjacent to Alban and Iosco soils on the landscape. Menominee soils are well drained and are underlain by calcareous loamy glacial drift. Alban soils are similar to the Alban Variant soils in position on the landscape but do not have the 20- to 36-inch-thick sandy mantle. Iosco soils are somewhat poorly drained and are in lower landscape positions in drainageways and depressions.

Typical pedon of Alban Variant loamy sand, 2 to 6 percent slopes, approximately 1,270 feet west and 50 feet south of the northeast corner of sec. 2, T. 28 N., R. 11 E.

Ap—0 to 9 inches; dark brown (7.5YR 3/2) loamy sand, brown (7.5YR 5/2) dry; weak medium granular structure; very friable; many roots; medium acid; abrupt smooth boundary.

B21ir—9 to 13 inches; reddish brown (5YR 4/4) sand; weak medium subangular blocky structure; very friable; common roots; medium acid; abrupt wavy boundary.

B22ir—13 to 18 inches; brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; common roots; medium acid; clear wavy boundary.

B3—18 to 22 inches; brown (7.5YR 4/4) sand; single grain; loose; common roots; medium acid; abrupt wavy boundary.

IIB2t—22 to 25 inches; brown (7.5YR 4/4) loam; common medium distinct yellowish red (5YR 5/6) and prominent yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; friable; common roots; very strongly acid; clear wavy boundary.

IIC1—25 to 44 inches; mixed brown (7.5YR 5/4 and 10YR 5/3) and reddish brown (5YR 4/4) stratified silt loam, loam, sandy loam, and sand; common medium faint reddish brown (5YR 5/4) and common medium distinct yellowish red (5YR 5/6) mottles; massive; friable; strongly acid; abrupt wavy boundary.

IIC2—44 to 60 inches; brown (7.5YR 5/4) sand with thin strata of loamy sand; common coarse distinct yellowish red (5YR 4/6) mottles; single grain; loose; strongly acid.

Solum thickness ranges from 24 to 50 inches. Thickness of the sandy mantle ranges from 20 to 36 inches. Reaction ranges from very strongly acid to medium acid in the subsoil and from strongly acid to slightly acid in the substratum.

The Ap horizon has hue of lOYR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. Some pedons have an Al horizon 1 to 4 inches thick with hue of lOYR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. Some pedons do not have an A1 horizon and have only a thin 0 horizon over an A2 horizon. The Bir horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is sand or loamy sand. The B3 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. It is sand or loamy sand. Some pedons have an A'2 horizon. The IIB2t horizon has hue of 5YR to 10YR and value and chroma of 4 to 6. It is loam, silt loam, or sandy loam. The IIC horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6.

Angelica series

The Angelica series consists of poorly drained and very poorly drained, moderately slowly permeable soils on ground moraines. These soils formed in loamy glacial till. Slope ranges from 0 to 2 percent. In Shawano County these soils have a slightly thicker dark surface layer than is defined for the series and have free carbonates throughout, but these differences do not alter their usefulness and behavior.

Angelica soils are commonly adjacent to Bach, Cathro, Onaway, and Solona soils on the landscape. Bach soils are similar to the Angelica soils in position on the landscape but have more silt and less sand and clay in the subsoil. Cathro soils are similar to or slightly lower than, the Angelica soils in position on the landscape but have a 16- to 51-inch-thick organic layer. Onaway soils occupy higher landscape positions and are well drained and moderately well drained. Solona soils are somewhat poorly drained and occupy slightly higher landscape positions than do the Angelica soils.

Typical pedon of Angelica silt loam, approximately 2,240 feet north and 50 feet east of the southwest corner of sec. 26, T. 25 N., R. 17 E.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; common roots; few pores; some dark gray (5Y 4/1) soil mixed in by plowing; about 2 percent pebbles; slight effervescence; mildly alkaline; abrupt smooth boundary.

B21g—9 to 14 inches; dark gray (5Y 4/1) loam; common fine prominent light olive brown (2.5Y 5/6) mottles; moderate very fine subangular blocky structure; friable; few roots; common pores; some black (10YR 2/1) soil in worm and root channels; some light brown (7.5YR 6/4) soil in worm channels; about 2 percent pebbles; slight effervescence; mildly alkaline; clear wavy boundary.

B22—14 to 19 inches; light brown (7.5YR 6/4) loam; common fine distinct pinkish gray (7.5YR 6/2), strong brown (7.5YR 5/6), and light olive brown (2.5Y 5/6) mottles and common medium distinct grayish brown (2.5Y 5/2) mottles; moderate very fine subangular blocky structure; firm; few roots; common pores; about 2 percent pebbles; slight effervescence; mildly alkaline; clear wavy boundary.

B23—19 to 23 inches; reddish brown (5YR 5/4) loam; many fine prominent light brownish gray (2.5Y 6/2) and common fine prominent (5YR 4/8) mottles; weak medium and fine subangular blocky structure; firm; few roots; common pores; about 8 percent pebbles; strong effervescence; mildly alkaline; clear wavy boundary.

C1—23 to 38 inches; reddish brown (5YR 5/4) loam; many fine prominent light brownish gray (2.5Y 6/2) and yellowish red (5YR 4/8) mottles; massive; friable; few roots; common pores; about 10 percent pebbles; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—38 to 60 inches; reddish brown (5YR 5/3) sandy loam; few fine prominent light brownish gray (2.5Y 6/2) and common fine and medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; common pores; about 10 percent pebbles; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 12 to 24 inches. Depth to free carbonates ranges from 0 to 20 inches. Reaction of the solum ranges from slightly acid to mildly alkaline. Reaction of the substratum is mildly alkaline or moderately alkaline. The content of coarse fragments is 10 percent or less throughout the pedon.

The A horizon has color value of 2 or 3 and chroma of 1 or 2. The B horizon has hue of 7.5YR to 2.5Y, value of 5 or 6, and chroma of 1 or 2. In some pedons the lower part of the B horizon has chroma of 3 or 4. The B horizon is loam or clay loam. The C horizon has hue of 5YR to 2.5Y, value of 5 or 6, and chroma of 2 or 4. It is loam or sandy loam.

Antigo series

The Antigo series consists of well drained, moderately over rapidly or very rapidly permeable soils on outwash plains and stream terraces. These soils formed mostly in silty deposits and are underlain by stratified sand and gravel. Slope ranges from 1 to 6 percent.

Antigo soils are adjacent to Brill and Rosholt soils on the landscape. Brill soils are similar to, or slightly lower than, the Antigo soils in position on the landscape but are moderately well drained. Rosholt soils are similar to the Antigo soils in position on the landscape but have more sand and less clay in the upper part of the solum.

Typical pedon of Antigo silt loam, 1 to 6 percent slopes, approximately 1,080 feet south and 780 feet west of the northeast corner of sec. 34, T. 28 N., R. 11 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, very pale brown (10YR 7/3) dry; moderate very fine subangular blocky structure; friable; many roots; very strongly acid; abrupt smooth boundary.

B&A—8 to 14 inches; dark brown (7.5YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; friable; occupies about 75 percent of the horizon; penetrated by tongues of brown (10YR 5/3) silt loam (A2), pinkish gray (7.5YR 7/2) dry; weak thin platy structure; friable; common roots; very strongly acid; clear wavy boundary.

B21t—14 to 23 inches; dark brown (7.5YR 4/4) silt loam; moderate fine subangular blocky structure; friable; common roots; thin continuous clay films on faces of peds; pale brown (10YR 6/3) coatings on vertical faces of peds; very strongly acid; clear wavy boundary.

B22t—23 to 29 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable;common roots; thin continuous clay films on faces of peds; pale brown (10YR 6/3) coatings on vertical faces of peds; very strongly acid; clear wavy boundary.

B23t—29 to 33 inches; dark brown (7.5YR 4/4) silt loam; moderate thick platy structure parting to moderate fine angular and subangular blocky; friable; few roots; thin continuous clay films on vertical faces of peds and thin patchy clay films on horizontal faces of peds; patchy pale brown (10YR 6/3) coatings on faces of some peds; few thin strata of fine and very fine sand; very strongly acid; clear wavy boundary.

IIB3t—33 to 37 inches; dark brown (7.5YR 4/4) sandy loam; weak coarse angular and subangular blocky structure; friable; few roots; thin discontinuous clay films on faces of peds; patchy pale brown (10YR 6/3) coatings on faces of some peds; about 5 percent pebbles; strongly acid; abrupt smooth boundary.

IIC—37 to 60 inches; brown (7.5YR 5/4) sand with strata of gravel; single grain; loose; about 15 percent pebbles; strongly acid.

Solum thickness ranges from 22 to 40 inches. Thickness of the silty mantle ranges from 20 to 36 inches. Reaction ranges from very strongly acid to medium acid in the solum and from strongly acid to slightly acid in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 4 inches thick with value of 2 or 3 and chroma of 1 or 2. Some pedons have an A2 horizon or an A&B horizon, or both. The A2 part of the B&A horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. The Bt part of the B&A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The B2t horizon has color and texture the same as the Bt part of the B&A horizon. The IIB3t horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 4 to 6. It is loam, sandy loam, loamy sand, gravelly loam, gravelly sandy loam, or gravelly loamy sand. The IIC horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 3 to 6.

Au Gres series

The Au Gres series consists of somewhat poorly drained, rapidly permeable soils on outwash plains, in lake basins, and on ground moraines. These soils formed in sandy outwash deposits. Slope ranges from 0 to 3 percent.

Au Gres soils are similar to Wainola soils and are commonly adjacent to Cormant, Croswell, and Rubicon soils on the landscape. Wainola soils are dominantly fine sand. Cormant soils are poorly drained and very poorly drained and occupy lower landscape positions. Croswell soils are moderately well drained and occupy slightly higher landscape positions. Rubicon soils are excessively drained and occupy higher landscape positions on knolls.

Typical pedon of Au Gres loamy sand, 0 to 3 percent slopes, approximately 1,700 feet north and 15 feet east of the southwest corner of sec. 20, T. 27 N., R. 15 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many roots; slightly acid; abrupt smooth boundary.

B21ir—8 to 13 inches; dark brown (7.5YR 4/4) loamy sand; few fine distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; very friable; many roots; strongly acid; clear wavy boundary.

B22ir—13 to 22 inches; dark brown (7.5YR 4/4) sand; few fine prominent strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; very friable; common roots; medium acid; clear wavy boundary.

B23ir—22 to 37 inches; brown (7.5YR 5/4) sand; many coarse prominent strong brown (7.5YR 5/8) and yellowish red (5YR 5/8) mottles; weak coarse and medium subangular blocky structure; very friable; few roots; medium acid; gradual wavy boundary.

C—37 to 60 inches; brown (7.5YR 5/2) sand; single grain; loose; medium acid.

Solum thickness ranges from 20 to 40 inches. Reaction ranges from strongly acid to neutral in the solum and is strongly acid or medium acid in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. Some pedons have an A1 horizon ranging from 1 to 4 inches thick. It has hue of l0YR or 7.5YR, value of 2 or

3, and chroma of 1 or 2. Some pedons have an A2 horizon. Some pedons have a B21hir horizon with small amounts of ortstein. The B2ir horizon has hue of 5YR to 10YR and value and chroma of 4 to 6. Some pedons have a B3 horizon. The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4.

Au Gres Variant

The Au Gres Variant consists of somewhat poorly drained, rapidly permeable soils on outwash plains. These soils formed in sand deposited by wind and water over stratified calcareous sand and gravel. Slope ranges from 0 to 3 percent.

Au Gres Variant soils are similar to Au Gres, Wainola, and Wheatley soils and are adjacent to Wheatley soils on the landscape. Au Gres and Wainola soils have less gravel and no free carbonates in the substratum. In addition, Wainola soils contain more than 50 percent fine sand. Wheatley soils are poorly drained and very poorly drained and occupy lower positions on the landscape than do the Au Gres Variant soils.

Typical pedon of Au Gres Variant loamy fine sand, 0 to 3 percent slopes, approximately 75 feet west and 50 feet north of the southeast corner of sec. 25, T. 26 N., R. 16 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak medium and coarse granular structure; friable; common roots; mildly alkaline; abrupt smooth boundary.

A2—9 to 14 inches; dark grayish brown (10YR 4/2) fine sand, light brownish gray (10YR 6/2) dry; many coarse prominent strong brown (7.5YR 5/6) and red (2.5YR 5/8) mottles; weak thick platy structure; very friable; few roots; mildly alkaline; clear wavy boundary.

B21—14 to 22 inches; brown (7.5YR 4/4) fine sand; many medium distinct red (2.5YR 4/6) mottles and many medium prominent yellowish red (5YR 5/8) mottles; weak medium and coarse subangular blocky structure; very friable; mildly alkaline; gradual wavy boundary.

B22—22 to 28 inches; brown (7.5YR 4/4) loamy sand; few fine prominent yellowish red (5YR 5/8) mottles; weak medium and coarse subangular blocky structure; very friable; mildly alkaline; abrupt wavy boundary.

IIC—28 to 60 inches; grayish brown (10YR 5/2) sand stratified with gravel; single grain; loose; about 25 percent pebbles; strong effervescence; moderately alkaline.

Solum thickness and depth to carbonates range from 20 to 36 inches. The content of pebbles ranges from 20 to 45 percent in the substratum. Reaction ranges from slightly acid to mildly alkaline in the the solum and is mildly alkaline or moderately alkaline in the substratum.

The Ap horizon has value of 2 to 4 and chroma of 1 to 3. The A2 horizon has hue of lOYR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is fine sand, loamy fine sand, loamy sand, or sand. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sand, fine sand, or loamy sand. The IIC horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

Bach series

The Bach series consists of poorly drained and very poorly drained, moderately permeable soils in basins of glacial lakes. These soils formed in silty, loamy, and sandy calcareous lacustrine deposits. Slope ranges from 0 to 2 percent. In Shawano County these soils have a slightly cooler soil temperature than is defined for the series and do not have a cambic horizon, but these differences do not alter their usefulness and behavior.

Bach soils are similar to Shiocton soils and are adjacent to Angelica, Cormant, and Shiocton soils on the landscape. Shiocton soils are somewhat poorly drained and occupy slightly higher positions in the landscape. Angelica soils are similar to the Bach soils in position on the landscape but formed in glacial till. Cormant soils occupy similar landscape positions but are sandy.

Typical pedon of Bach silt loam, approximately 200 feet east and 30 feet south of the center of sec. 20, T. 27 N., R. 18 E.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine and very fine subangular blocky structure; friable; many roots; mildly alkaline; abrupt smooth boundary.

C1g—8 to 12 inches; gray (10YR 5/1) stratified silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; parts to thin platy fragments; friable; common roots; slight effervescence; mildly alkaline; clear smooth boundary.

C2g—12 to 16 inches; light brownish gray (10YR 6/2) stratified loamy very fine sand; common medium prominent yellowish brown (10YR 5/6) mottles; parts to thin platy fragments; friable; common roots; slight effervescence, mildly alkaline; clear wavy boundary.

C3g—16 to 24 inches; light brownish gray (10YR 6/2) stratified very fine sandy loam and silt loam with thin lenses of very fine sand; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; strong effervescence; moderately alkaline; clear wavy boundary.

C4—24 to 29 inches; light brownish gray (10YR 6/2) stratified loamy very fine sand and very fine sandy loam; many medium prominent yellowish brown (10YR 5/6 and 5/8) mottles; massive; friable; few roots; few small lime concretions; strong effervescence; moderately alkaline; clear wavy boundary.

C5—29 to 48 inches; light brownish gray (10YR 6/2) stratified silt loam and very fine sand; many medium prominent yellowish brown (10YR 5/8) mottles; massive; friable; strong effervescence; mildly alkaline; clear wavy boundary.

C6g—48 to 60 inches; gray (10YR 5/1) silt loam; few fine prominent yellowish brown (10YR 5/6) mottles; massive; friable; strong effervescence; mildly alkaline.

Solum thickness ranges from 20 to 36 inches. Depth to free carbonates ranges from 0 to 10 inches. Reaction ranges from neutral to moderately alkaline in the surface layer and is mildly alkaline or moderately alkaline in the substratum.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Cg and C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 3. They are stratified with layers of silt, silt loam, loam, very fine sandy loam, loamy very fine sand, fine sandy loam, and very fine sand.

Boyer series

The Boyer series consists of well drained, moderately rapidly over very rapidly permeable soils on outwash plains. These soils formed in loamy glacial drift underlain by calcareous stratified sand and gravel. Slope ranges from 1 to 6 percent. In Shawano County these soils have a slightly cooler soil temperature than is defined for the series, but this difference does not alter their usefulness and behavior.

Boyer soils are similar to Alban, Lorenzo Variant, Rosholt, and Salter Variant soils and are commonly adjacent to Lorenzo Variant soils on the landscape. Alban soils are underlain by stratified loamy lacustrine deposits. Lorenzo Variant soils are similar to the Boyer soils in position on the landscape but have a thinner solum and have free carbonates at a shallower depth. Rosholt soils are underlain by acid sand and gravel. Salter Variant soils are underlain by calcareous, stratified loamy lacustrine deposits.

Typical pedon of Boyer sandy loam, 1 to 6 percent slopes, approximately 700 feet west and 25 feet north of the southeast corner of sec. 22, T. 26 N., R. 17 E.

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

B1—7 to 17 inches; brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; common roots; about 2 percent pebbles; neutral; clear wavy boundary.

B21t—17 to 24 inches; reddish brown (5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; thin discontinuous clay films on faces of peds; common roots; about 5 percent pebbles; neutral; clear wavy boundary.

IIB22t—24 to 28 inches; reddish brown (5YR 4/4) gravelly sandy loam, weak medium subangular blocky structure; very friable; clay bridging between sand grains; few roots; about 15 percent pebbles and 5 percent cobbles; mildly alkaline; clear wavy boundary.

IIC—28 to 60 inches; brown (10YR 5/3) sand stratified with gravel; single grain; loose; few roots; about 30 percent pebbles; few thin strata of loamy sand; strong effervescence; mildly alkaline.

Solum thickness ranges from 20 to 40 inches and corresponds to the depth to calcareous sand and gravel. The content of pebbles ranges from 1 to 25 percent in the solum. Cobble content ranges from 0 to 2 percent in the solum and from 0 to 8 percent in the substratum. Reaction ranges from medium acid to neutral in the upper part of the subsoil and from slightly acid to mildly alkaline in the lower part. Reaction is mildly alkaline or moderately alkaline in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A2 horizon. Some pedons have no B1 horizon. The Bt horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 to 6. It is loam, sandy loam, fine sandy loam, or the gravelly analogues of these textures. The IIC horizon has value of 5 or 6 and chroma of 2 to 4.

Brevort series

The Brevort series consists of poorly drained and very poorly drained, rapidly over moderately slowly permeable soils on ground moraines and in basins of glacial lakes. These soils formed in sandy deposits over loamy till or lacustrine deposits. Slope ranges from 0 to 2 percent. In Shawano County these soils have a slightly higher chroma in the upper part of the C horizon than is defined for the series, but this difference does not alter their usefulness or behavior.

Brevort soils are similar to Cormant soils and are commonly adjacent to Iosco, Markey, and Menominee soils on the landscape. Cormant soils are sandy throughout. Iosco soils occupy slightly higher landscape positions than do the Brevort soils and are somewhat poorly drained. Markey soils are similar to, or slightly lower than, the Brevort soils in position on the landscape and have a 16- to 51-inch-thick organic layer that the Brevort soils do not have. Menominee soils are well drained and occupy higher landscape positions on knolls.

Typical pedon of Brevort mucky loamy sand, approximately 400 feet north and 2,000 feet west of southeast corner of sec. 28, T. 27 N., R. 15 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) mucky loamy sand, grayish brown (2.5Y 5/2) dry; weak medium subangular blocky structure; friable; many roots; medium acid; abrupt smooth boundary.

C1g—8 to 15 inches; grayish brown (2.5Y 5/2) loamy sand; common medium prominent strong brown (7.5YR 5/6) and common medium faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; very friable; few roots; medium acid; clear wavy boundary.

C2—15 to 21 inches; grayish brown (10YR 5/2) sand; many fine prominent light olive brown (2.5Y 5/6) and common fine faint brown (10YR 5/3) mottles; single grain; very friable; few roots; medium acid; gradual wavy boundary.

IIC3—21 to 28 inches; brown (7.5YR 4/4) clay loam; common fine distinct yellowish red (5YR 4/8) and grayish brown (2.5Y 5/2) mottles; massive; firm; about 2 percent pebbles; medium acid; gradual wavy boundary.

IIC4—28 to 38 inches; yellowish red (5YR 4/6) loam; common fine distinct yellowish red (5YR 4/8) and common fine prominent grayish brown (2.5Y 5/2) mottles; massive; friable; about 2 percent pebbles; neutral; gradual wavy boundary.

IIC5—38 to 60 inches; yellowish red (5YR 4/6) loam; few fine distinct yellowish red (5YR 4/8) mottles; massive; firm; strong effervescence; mildly alkaline.

Thickness of the sandy mantle and depth to free carbonates range from 20 to 40 inches. Reaction ranges from medium acid to mildly alkaline in the upper part of the substratum and is mildly alkaline or moderately alkaline in the lower part.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The C1g horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. The C2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. The IIC horizon has hue of 2.5YR, 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 2 to 6. It is loam, clay loam, sandy loam, silt loam, or silty clay loam.

Briggsville series

The Briggsville series consists of well drained, moderately slowly permeable soils in basins of glacial lakes. These soils formed in clayey or silty glacial lacustrine deposits. Slope ranges from 0 to 6 percent. In Shawano County these soils have a slightly cooler soil temperature than is defined for the series, but this difference does not alter their usefulness and behavior.

Briggsville soils are adjacent to Manawa and Menominee soils on the landscape. Manawa soils are somewhat poorly drained and occupy slightly lower landscape positions in drainageways and depressions. Menominee soils are similar to the Briggsville soils in position on the landscape but have a 20- to 40-inch-thick sandy mantle over loamy drift.

Typical pedon of Briggsville silt loam, 0 to 2 percent slopes, approximately 1,290 feet south and 480 feet west of the center of sec. 24, T. 27 N., R. 15 E.

Ap—0 to 8 inches; dark brown (7.5YR 3/2) silt loam, pinkish gray (7.5YR 6/2) dry; moderate fine subangular blocky structure; friable; common roots; some reddish brown (5YR 4/4) soil mixed in by plowing; neutral; abrupt smooth boundary.

B21t—8 to 10 inches; reddish brown (5YR 4/4) silty clay; moderate fine subangular blocky structure; very firm; few roots; thin discontinuous clay films on faces of peds; brown (7.5YR 5/2), pinkish gray (7.5YR 7/2) dry, coatings on faces of some peds; neutral; abrupt smooth boundary.

B22t—10 to 24 inches; reddish brown (5YR 4/4) silty clay; moderate very fine subangular blocky structure; very firm; few roots; thin discontinuous clay films on faces of peds; slightly acid; clear wavy boundary.

B3t—24 to 28 inches; reddish brown (5YR 4/4) silty clay; weak very fine subangular blocky structure, very firm; thin patchy clay films on faces of peds; slight effervescence; mildly alkaline; clear wavy boundary.

C—28 to 60 inches; reddish brown (5YR 5/4) silty clay; weak thin platy structure; very firm; few thin strata of silt loam and very fine sand up to 1/4 inch thick; pinkish gray (7.5YR 6/2) lime coatings on faces of some peds; violent effervescence; mildly alkaline.

Solum thickness and depth to free carbonates range from 24 to 40 inches. Reaction ranges from medium acid to mildly alkaline in the solum and is mildly alkaline or moderately alkaline in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A2 horizon, and some have a B1 horizon. The B2t horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or silty clay. The C horizon has 5YR or 7.5YR hue, value of 4 or 5, and chroma of 3 or 4.

Brill series

The Brill series consists of moderately well drained, moderately permeable over rapidly or very rapidly permeable soils on outwash plains and stream terraces. These soils formed mostly in silty deposits and are underlain by sand and gravel. Slope ranges from 0 to 3 percent.

Brill soils are similar to Scott Lake soils and are commonly adjacent to Antigo and Rosholt soils on the landscape. Scott Lake soils have more sand and less clay in the subsoil. Antigo soils are similar to, or slightly higher than, the Brill soils in position on the landscape and are well drained. Rosholt soils are similar to, or slightly higher than, the Brill soils in position on the landscape but have more sand and less clay in the subsoil and are well drained.

Typical pedon of Brill silt loam, 0 to 3 percent slopes, approximately 500 feet south and 300 feet east of the northwest corner of sec. 20, T. 28 N., R. 11 E.

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

A2—7 to 12 inches; pale brown (10YR 6/3) silt loam, very pale brown (10YR 8/3) dry; weak thin platy structure; friable; common roots; strongly acid; clear wavy boundary.

B&A—12 to 17 inches; yellowish brown (10YR 5/4) silt loam (Bt); moderate fine subangular blocky structure; friable; occupies 70 percent of the horizon and is penetrated by tongues of pale brown (I0YR 6/3) silt loam (A2), very pale brown (I0YR 8/3) dry; weak thin platy structure; friable; few roots; strongly acid; clear wavy boundary.

B21t—17 to 29 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; thin discontinuous clay films on faces of peds; few roots; very strongly acid; clear wavy boundary.

B22t—29 to 34 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct yellowish brown (10YR 5/6) and few fine faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; thin discontinuous clay films on faces of peds; very strongly acid; clear wavy boundary.

IIB3—34 to 38 inches; yellowish brown (10YR 5/4) loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; about 2 percent pebbles; very strongly acid; clear wavy boundary.

IIC—38 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; about 15 percent pebbles; strongly acid.

Solum thickness ranges from 20 to 40 inches and thickness of the silty mantle ranges from 20 to 36 inches. Reaction ranges from very strongly acid to slightly acid in the subsoil and from strongly acid to neutral in the substratum. Pebble content ranges from 2 to 20 percent in the lower part of the subsoil and from 10 to 60 percent in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 4 inches thick with value of 2 or 3 and chroma of 1 or 2. The A2 horizon has value of 4 to 6 and chroma of 2 or 3. Some pedons have no A2 horizon. Some pedons have an A&B horizon. The A2 part of the B&A horizon has value and chroma similar to the A2 horizon. The Bt part of the B&A horizon has hue, value, chroma, and texture similar to the B2t horizon. The B2t horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma 4 or 5. It is silty clay loam or silt loam. The B3 or IIB3 horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 4 to 6. They are silt loam, loam, sandy loam, or loamy sand. The IIC horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 3 to 6.

Cathro series

The Cathro series consists of very poorly drained, moderately permeable soils on low-lying flats and in depressions on ground moraines, outwash plains, and basins of glacial lakes. These soils formed in organic material underlain by loamy mineral deposits. Slope ranges from 0 to 2 percent.

Cathro soils are adjacent to Angelica, Bach, Fordum, Markey, and Minocqua soils. Angelica, Bach, Fordum, and Minocqua soils are similar to, or slightly higher than, the Cathro soils in position on the landscape but do not have the 16- to 51-inch-thick organic layer of the Cathro soils. Markey soils are similar to the Cathro soils in position on the landscape but are underlain by sandy outwash.

Typical pedon of Cathro muck, from an area of Markey and Cathro mucks, approximately 1,620 feet north and 100 feet east of the center of sec. 12, T. 26 N., R. 16 E.

Oa1—0 to 14 inches; black (N 2/0) broken face sapric material, black (10YR 2/1) rubbed; about 10 percent fiber, 2 percent rubbed; moderate fine granular structure; many roots; dominantly herbaceous fibers; neutral (pH 7.2 by Truog method); clear wavy boundary.

Oa2—14 to 22 inches; black (N 2/0) broken face sapric material, black (10YR 2/1) rubbed; about 5 percent fiber, 2 percent rubbed; moderate medium platy structure; many roots; dominantly herbaceous fibers; neutral (pH 7.3 by Truog method); abrupt smooth boundary.

0a3—22 to 26 inches; very dark brown (10YR 2/2) broken face and rubbed sapric material; about 15 percent fiber, 3 percent rubbed; moderate thick platy structure; common roots; dominantly herbaceous fibers; neutral (pH 7.3 by Truog method); abrupt smooth boundary.

IIC—26 to 60 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; mildly alkaline.

Thickness of the organic layer and depth to underlying loamy soil both range from 16 to 51 inches. The organic layer is primarily from herbaceous plants, but it contains a few woody fragments in some pedons. Reaction ranges from medium acid to mildly alkaline in the organic layers and is neutral or mildly alkaline in the substratum.

The organic layer has hue of 10YR, value of 2 or 3, and chroma of 1 or 2, or it is neutral. Many pedons have a thin mat of undecomposed plant remains on the surface. Some pedons have thin hemic layers; their combined thickness is less than 10 inches. Some pedons have fibric layers; their combined thickness is less than 5 inches. In some pedons, the organic layer immediately above the IIC horizon is as much as 50 percent mineral material by volume. The IIC horizon has hue of 2.5Y, 10YR, 7.5YR, or 5YR; value of 4 to 6; and chroma of 1 or 2. It is fine sandy loam, very fine sandy loam, loam, silt loam, clay loam, or silty clay loam.

Cormant series

The Cormant series consists of poorly drained and very poorly drained, rapidly permeable soils on outwash plains and in basins of glacial lakes. These soils formed in sandy outwash deposits. Slope ranges from 0 to 2 percent.

Cormant soils are adjacent to Au Gres, Croswell, Rousseau, and Wainola soils on the landscape. Au Gres and Wainola soils are in slightly higher landscape positions than are the Cormant soils and are somewhat poorly drained. Croswell and Rousseau soils are moderately well drained and are on low rises.

Typical pedon of Cormant mucky loamy fine sand, approximately 300 feet north and 175 feet west of the center of sec. 19, T. 27 N., R. 17 E.

A1—0 to 8 inches; black (10YR 2/1) mucky loamy fine sand, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; friable; many roots; mildly alkaline; clear smooth boundary.

C1—8 to 11 inches; dark grayish brown (2.5Y 4/2) loamy fine sand; few fine prominent brownish yellow (10YR 6/6) mottles; single grain; loose; common roots; neutral; clear wavy boundary.

C2—11 to 17 inches; light brownish gray (2.5Y 6/2) fine sand; few fine prominent brownish yellow (10YR 6/6) mottles; single grain; loose; neutral; clear wavy boundary.

C3—17 to 26 inches; dark grayish brown (2.5Y 4/2) fine sand; few fine prominent yellowish brown (10YR 5/6) mottles; single grain; loose; mildly alkaline; gradual wavy boundary.

C4—26 to 45 inches; light brownish gray (2.5Y 6/2) fine sand; single grain; loose; mildly alkaline; gradual wavy boundary.

C5g—45 to 60 inches; dark gray (5Y 4/1) fine sand; single grain; loose; mildly alkaline.

Depth to free carbonates ranges from 36 inches to more than 60 inches. Reaction is slightly acid or mildly alkaline in the upper part of the substratum and is neutral or mildly alkaline in the lower part.

The A1 horizon ranges from 1 to 8 inches thick. It has value of 2 or 3 and chroma of 1 or 2. Where present, the Ap horizon has value of 2 to 4 and chroma of 2 or 3. The C horizon has hue of 7.5YR, 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is sand, fine sand, loamy fine sand, or loamy sand in the upper part and is sand or fine sand in the lower part.

Cromwell series

The Cromwell series consists of excessively drained, moderately over rapidly permeable soils on outwash plains. These soils formed in loamy and sandy outwash deposits. Slope ranges from 1 to 20 percent.

Cromwell soils are similar to Rosholt soils and are near Mahtomedi, Menahga, and Rosholt soils on the landscape. Rosholt soils are similar to the Cromwell soils in position on the landscape but have a thicker loamy mantle and also have a zone of clay accumulation in the subsoil. Menahga and Mahtomedi soils occupy similar landscape positions but do not have the 12- to 24-inch-thick sandy loam mantle of Cromwell soils.

Typical pedon of Cromwell sandy loam, 1 to 6 percent slopes, approximately 1,100 feet north and 1,000 feet east of the southwest corner of sec. 30, T. 29 N., R. 11 E.

Ap—0 to 10 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; common roots; strongly acid; abrupt smooth boundary.

B2—10 to 17 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common roots; strongly acid; clear smooth boundary.

IIB31—17 to 27 inches; dark brown (7.5YR 4/4) loamy sand; weak medium and coarse subangular blocky structure; very friable; few roots; strongly acid; gradual wavy boundary.

IIB32—27 to 43 inches; dark brown (7.5YR 4/4) sand; single grain; loose; medium acid; gradual wavy boundary.

IIC1—43 to 53 inches; brown (7.5YR 5/4) sand; single grain; loose; slightly acid; gradual wavy boundary.

IIC2—53 to 60 inches; light brown (7.5YR 6/4) sand; single grain; loose; medium acid.

Solum thickness ranges from 32 to 50 inches. Thickness of the sandy loam mantle ranges from 12 to 24 inches. Pebble content ranges from 0 to 8 percent in the solum and from 0 to 30 percent in the substratum. Reaction ranges from strongly acid to medium acid in the subsoil and from strongly acid to slightly acid in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon that ranges from 1 to 3 inches thick and has value of 2 or 3 and chroma of 1 or 2. Some pedons have an A2 horizon. The B horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. The C horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 4 to 6; and chroma of 3 or 4.

Croswell series

The Croswell series consists of moderately well drained, rapidly permeable soils on outwash plains, on ground moraines, and in basins of glacial lakes. These soils formed in sandy outwash deposits. Slope ranges from 0 to 3 percent.

Croswell soils are similar to Rousseau soils and are adjacent to Au Gres, Menahga, and Rubicon soils on the landscape. Rousseau soils are more than 50 percent fine sands. Au Gres soils occupy slightly lower landscape positions than do the Croswell soils and are somewhat poorly drained. Menahga and Rubicon soils occupy slightly higher landscape positions than do the Croswell soils and are excessively drained.

Typical pedon of Croswell loamy sand, 0 to 3 percent slopes, approxmately 500 feet south and 110 feet east of the center of sec. 10, T. 28 N., R. 14 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, brown (7.5YR 5/2) dry; weak medium subangular blocky structure; very friable; many roots; slightly acid; abrupt smooth boundary.

A2—9 to 12 inches; brown (7.5YR 4/2) loamy sand, pinkish gray (7.5YR 6/2) dry; weak fine subangular blocky structure; very friable; common roots; slightly acid; clear wavy boundary.

B21ir—12 to 22 inches; dark reddish brown (5YR 3/4) loamy sand; weak fine subangular blocky structure; very friable; common roots; strongly acid; gradual wavy boundary.

B22ir—22 to 25 inches; dark brown (7.5YR 4/4) sand; single grain; loose; few roots; medium acid; gradual wavy boundary.

B3—25 to 36 inches; strong brown (7.5YR 5/6) sand; common fine faint yellowish red (5YR 4/6) mottles; single grain; loose; about 3 percent pebbles; medium acid; gradual wavy boundary.

C—36 to 60 inches; yellowish brown (l0YR 5/6) sand; common fine distinct strong brown (7.5YR 5/8) mottles; single grain; loose; about 1 percent pebbles; slightly acid.

Solum thickness ranges from 24 to 40 inches. Reaction ranges from very strongly acid to slightly acid in the subsoil and from medium acid to neutral in the substratum.

The Ap horizon has value of 3 or 4. Some pedons have an A1 horizon that ranges from 1 to 4 inches thick and has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has hue of l0YR or 7.5YR, value of 4 to 7, and chroma of 1 or 2. The B21ir horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 to 5; and chroma of 4 to 6. It is sand or loamy sand. The B22ir horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Some pedons do not have a B3 horizon. The C horizon has value of 5 or 6 and chroma of 3 to 6.

Elderon series

The Elderon series consists of somewhat excessively drained, rapidly over very rapidly permeable soils on eskers, kames, and edges of moraines. These soils formed in thin gravelly and cobbly loamy deposits over cobbly or gravelly loamy sand or sand (fig. 12). Slope ranges from 2 to 35 percent.

Elderon soils are similar to Rosholt soils and are adjacent to Cromwell and Kennan soils and to Rosholt soils in an intricate pattern on the landscape. Rosholt and Cromwell soils are similar to the Elderon soils in position on the landscape but have fewer coarse fragments. Kennan soils are on moraines and drumlins and formed in sandy and loamy glacial till. All areas of Elderon soils in this county are mapped in complex with Rosholt soils.

Typical pedon of Elderon gravelly sandy loam, from an area of Elderon-Rosholt complex, 12 to 20 percent slopes, approximately 1,275 feet east and 460 feet north of the southwest corner of sec. 35, T. 29 N., R. 11 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable; common fine roots; about 10 percent pebbles and 5 percent cobbles; slightly acid; abrupt smooth boundary.

B21—7 to 15 inches; dark reddish brown (5YR 3/4) very cobbly coarse sandy loam; moderate fine and medium subangular blocky structure; friable; common fine roots; about 30 percent cobbles and 22 percent pebbles; slightly acid; clear wavy boundary.

B22t—15 to 33 inches; dark brown (7.5YR 4/4) very cobbly loamy coarse sand; weak fine and medium subangular blocky structure; very friable; few fine roots; thin discontinuous clay films on faces of peds and on pebbles and cobbles; clay bridging between sand grains; about 30 percent cobbles and 35 percent pebbles; medium acid; gradual wavy boundary.

B3t—33 to 44 inches; brown (7.5YR 4/4) very cobbly loamy coarse sand, weak medium subangular blocky structure; very friable; few fine roots; few thin clay films on faces of peds; clay bridging between sand grains; about 30 percent cobbles and 43 percent pebbles; some dolomitic coarse fragments; neutral; gradual wavy boundary.

C—44 to 60 inches; brown (7.5YR 5/4) very cobbly coarse sand; single grain; loose; about 30 percent cobbles and 40 percent pebbles; some dolomitic coarse fragments; mildly alkaline.

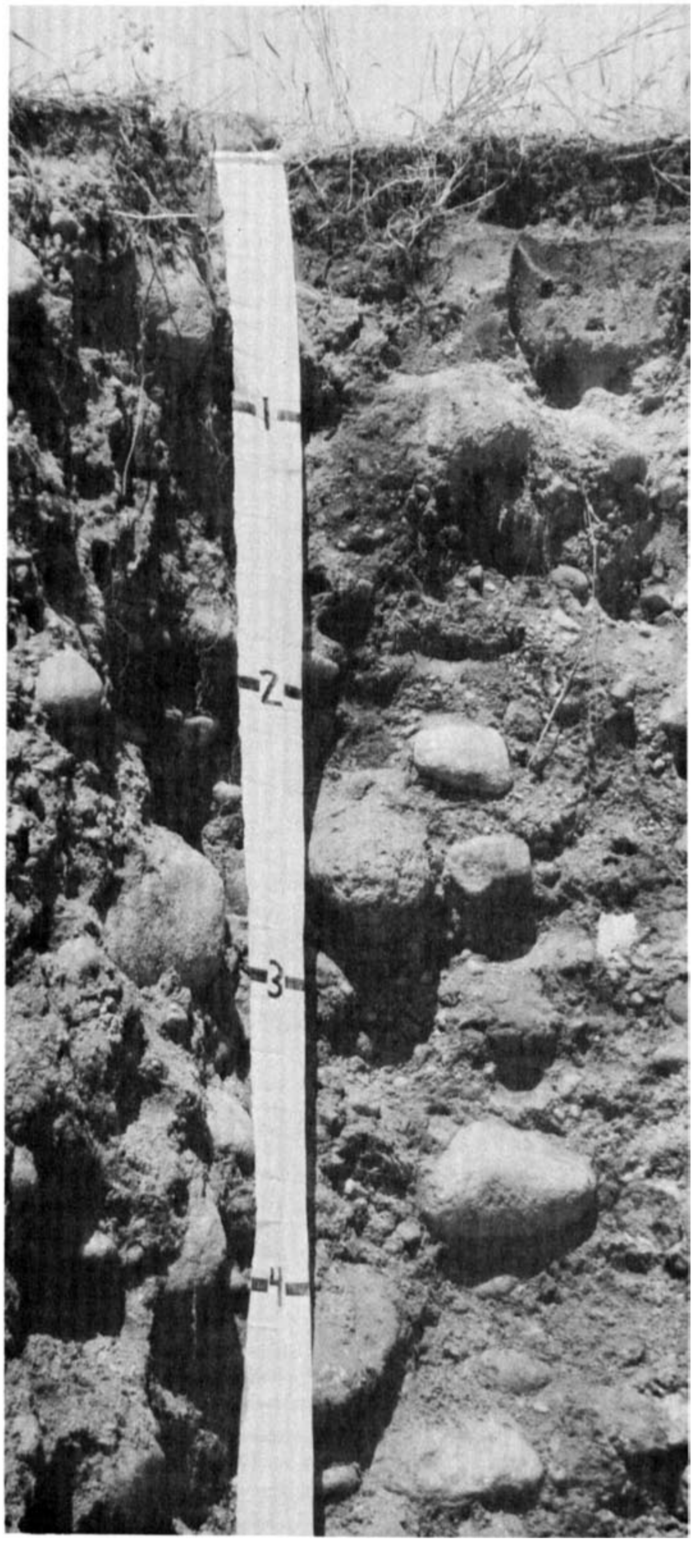

Figure 12.—Typical profile of Elderon gravelly sandy loam. These soils formed in a thin loamy mantle and in sandy, gravelly, and cobbly glacial drift. Tape measure is in feet.

Solum thickness ranges from 20 to 50 inches. The content of cobbles and pebbles ranges from 35 to 75 percent in the subsoil and the substratum. Reaction ranges from strongly acid to neutral in the solum and is neutral or mildly alkaline in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 4 inches thick with value of 2 or 3 and chroma of 1 or 2. Some pedons have an A2 horizon. The B21 horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 4 to 6. It is sandy loam or coarse sandy loam and is cobbly and gravelly. The B22t horizon has hue of 5YR, 7.5YR, or 10YR; value and chroma is 4 or 5. It is loamy sand, sand, loamy coarse sand, or coarse sand and is cobbly and gravelly. Some pedons do not have a B3t horizon. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6.

Fairport series

The Fairport series consists of well drained, moderately permeable soils on glaciated uplands underlain by dolomite. These soils formed in loamy glacial till overlying dolomite at depths of 20 to 40 inches. Slope ranges from 1 to 20 percent.

Fairport soils are adjacent to Onaway soils on the landscape. Onaway soils are similar to the Fairport soils in position on the landscape but are underlain by till rather than dolomite.

Typical pedon of Fairport fine sandy loam, 1 to 6 percent slopes, approximately 400 feet west and 1,900 feet north of the center of sec. 2, T. 26 N., R. 16 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; few roots; neutral; abrupt smooth boundary.

A2—9 to 11 inches; brown (10YR 4/3) loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; friable; few roots; neutral; abrupt smooth boundary.

B2t—11 to 25 inches; reddish brown (5YR 4/4) clay loam; moderate very fine subangular blocky structure; firm; few roots; thin continuous clay films on faces of peds; about 2 percent pebbles; neutral; gradual wavy boundary.

B3t—25 to 30 inches; reddish brown (5YR 4/4) loam; moderate medium and fine subangular blocky structure; friable; few roots; thin patchy clay films on faces of peds; about 2 percent pebbles; neutral; clear wavy boundary.

C—30 to 38 inches; reddish brown (5YR 4/4) sandy loam; massive; friable; about 5 percent pebbles; strong effervescence; mildly alkaline; abrupt smooth boundary.

IIR—38 inches; light yellowish brown (10YR 6/4) dolomite.

Solum thickness and depth to free carbonates range from 15 to 35 inches. Depth to dolomite ranges from 20 to 40 inches. Reaction ranges from medium acid to mildly alkaline in the solum and is mildly alkaline or moderately alkaline in the substratum.

The Ap horizon has value of 2 or 3 and chroma of 3 or 4. Some pedons have an A1 horizon that ranges from 1 to 4 inches thick and has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. It is loam, silt loam, or fine sandy loam. Some pedons do not have an A2 horizon. Some pedons have an A&B horizon or B&A horizon, or both. The Bt part of these horizons is similar to the B2t horizon. The B2t horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam, clay loam, or sandy clay loam. The B3t horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. It is loam or sandy loam. The C horizon has hue of 5YR, 7.5YR, or l0YR; value and chroma is 4 to 6. It is loam or sandy loam. Some pedons do not have a C horizon.

Fordum series

The Fordum series consists of poorly drained and very poorly drained, moderately over rapidly permeable soils on the lowest flood plains adjacent to stream or river channels. These soils formed in recently deposited loamy over sandy alluvium. Slope ranges from 0 to 2 percent.

Fordum soils are similar to Minocqua soils and are adjacent to Cathro, Cormant, Markey, and Minocqua soils on the landscape. Minocqua soils are similar to the Fordum soils in position on the landscape but have a subsoil development that is not present in Fordum soils. Cathro and Markey soils are in similar landscape positions but have 16 to 51 inches of organic material overlying mineral soil. Cormant soils are in similar landscape positions but are sandy throughout.

Typical pedon of Fordum loam, approximately 1,400 feet south and 1,450 feet west of the northeast corner of sec. 31, T. 26 N., R. 16 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; few fine prominent strong brown (7.5YR 5/8) mottles; moderate fine granular structure; friable; common fine and very fine roots; neutral; clear wavy boundary.

C1—8 to 24 inches; dark grayish brown (10YR 4/2) loam; common medium prominent strong brown (7.5YR 5/8) mottles; weak fine subangular blocky structure; friable; few fine roots; moderately alkaline; clear wavy boundary.

C2—24 to 30 inches; grayish brown (10YR 5/2) fine sandy loam; common medium prominent strong brown (7.5YR 5/8) mottles; massive but breaks along horizontal planes; very friable; many thin strata of loam; moderately alkaline; clear wavy boundary.

IIC3—30 to 60 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; moderately alkaline.

Thickness of the loamy mantle ranges from 25 to 60 inches. Reaction ranges from very strongly acid to moderately alkaline throughout the soil. In most pedons there are no pebbles, but in some there are up to 20 percent pebbles.

The A1 horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 0 to 3. The C horizon has hue of 7.5YR to 5Y, value of 2 to 5, and chroma of 0 to 3. It is loam, fine sandy loam, sandy loam, or silt loam. The IIC horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 4. It is sand, fine sand, loamy sand, or loamy fine sand and is gravelly in some pedons.

Iosco series

The Iosco series consists of somewhat poorly drained, rapidly over moderately slowly permeable soils on ground moraines, on outwash plains, and in basins of glacial lakes. These soils formed in sandy outwash and in the underlying loamy glacial till or lacustrine deposits. Slope ranges from 0 to 3 percent.

Iosco soils are commonly adjacent to Brevort and Menominee soils on the landscape. Brevort soils occupy lower landscape positions and are poorly drained and very poorly drained. Menominee soils occupy higher landscape positions and are well drained.

Typical pedon of Iosco loamy sand, 0 to 3 percent slopes, approximately 2,000 feet south and 660 feet east of the center of sec. 28,T. 27 N., R. 15 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; many roots; medium acid; abrupt smooth boundary.

B21ir—8 to 12 inches; brown (7.5YR 4/4) loamy sand; few fine prominent yellowish red (5YR 4/8) mottles; weak coarse subangular blocky structure; very friable; few roots; medium acid; clear wavy boundary.

B22ir—12 to 24 inches; brown (7.5YR 5/4) loamy sand; common medium prominent yellowish red (5YR 4/8) and common medium distinct brown (7.5YR 5/2) mottles; weak coarse subangular blocky structure; very friable; few roots; medium acid; clear wavy boundary.

IIB&A—24 to 29 inches; reddish brown (5YR 4/4) loam (Bt); common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; remnants of grayish brown (10YR 5/2) loamy sand (A2), very pale brown (10YR 7/3) dry, occupy about 40 percent of the volume; weak thick platy structure; very friable; few roots; slighty acid; clear wavy boundary.

IIB2t—29 to 40 inches; reddish brown (5YR 4/4) loam; common fine distinct strong brown (7.5YR 5/6) and brown (7.5YR 5/2) mottles; moderate medium subangular blocky structure; friable; thin discontinuous clay films on faces of peds; few roots; slightly acid; clear wavy boundary.

IIB3—40 to 46 inches; reddish brown (5YR 4/4) loam; few fine distinct strong brown (7.5YR 5/6) and brown (7.5YR 5/2) mottles; weak medium subangular blocky structure; friable; slightly acid; clear wavy boundary.

IIC—46 to 60 inches; reddish brown (5YR 4/4) loam; massive; friable; slightly acid.

Thickness of the sandy mantle ranges from 20 to 40 inches. Reaction ranges from strongly acid to slightly acid in the sandy mantle and from slightly acid to mildly alkaline in the loamy subsoil and in the substratum.

The Ap horizon has value of 3 or 4. Some pedons have an A1 horizon that ranges from 1 to 4 inches thick and has value of 2 or 3 and chroma of 1 or 2. Some pedons have an A2 horizon above the Bir horizon. The B2ir horizon has hue of 7.5YR or 10YR, value 3 to 5, and chroma of 2 to 6. Some pedons have an A'2 horizon instead of a B&A horizon. The A2 part of the B&A horizon has value of 5 or 6 and chroma of 2 or 3. The Bt part of the B&A horizon is similar to the IIB2t horizon. The IIB2t horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 3 to 6. It is loam, silty clay loam, or clay loam. The IIC horizon has hue of 5YR, 7.5YR, 10YR; value of 4 to 6; and chroma of 1 to 4. It is loam, clay loam, or silty clay loam.

Kennan series

The Kennan series consists of well drained, moderately permeable soils on ground moraines and drumlins. These soils formed in loamy drift over sandy loam or loamy sand glacial till. There are many stones and boulders on the surface. Slope ranges from 1 to 30 percent. In Shawano County these soils do not have enough clay increase for an argillic horizon as defined for the series, but this difference does not alter their usefulness and behavior.

Kennan soils are similar to Alban and Rosholt soils and are adjacent to Elderon and Rosholt soils on the landscape. Alban soils are on stream terraces and in basins of glacial lakes and are moderately well drained and formed in stratified loamy lacustrine deposits. Rosholt soils are on outwash plains and stream terraces and formed in loamy drift underlain by stratified sand and gravel outwash. Elderon soils are on eskers, kames, and edges of moraines and are gravelly and cobbly and underlain by cobbly or gravelly loamy sand or sand glacial drift.

Typical pedon of Kennan bouldery fine sandy loam, 1 to 6 percent slopes, approximately 100 feet south and 1,050 feet west of the northeast corner of sec. 29, T. 27 N., R. 12 E.

A1—0 to 2 inches; black (10YR 2/1) bouldery fine sandy loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; many roots; about 5 percent pebbles; neutral; abrupt smooth boundary.

B2ir—2 to 5 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak very fine subangular blocky structure; friable; common roots; about 7 percent pebbles; very strongly acid; abrupt wavy boundary.

A2—5 to 9 inches; brown (10YR 5/3) fine sandy loam, very pale brown (10YR 7/3) dry; weak medium platy structure; friable; common roots; about 8 percent pebbles; strongly acid; clear wavy boundary.

A&B—9 to 16 inches; brown (10YR 5/3) fine sandy loam (A2), very pale brown (10YR 7/3) dry; weak medium platy structure; very friable; remnants of dark brown (7.5YR 4/4) fine sandy loam (Bt) occupy about 40 percent of the horizon; moderate fine subangular blocky structure; friable; common roots; thin patchy clay films on faces of peds (Bt); about 10 percent pebbles; strongly acid; gradual wavy boundary.

B&A—16 to 25 inches; dark brown (7.5YR 4/4) sandy loam (Bt); moderate medium and fine subangular blocky structure; friable; tongues of brown (10YR 5/3) sandy loam (A2), very pale brown (10YR 7/3) dry, penetrate the horizon; weak medium platy structure; friable; few roots; thin discontinuous clay films on faces of peds (Bt); about 12 percent pebbles; slightly acid; gradual wavy boundary.

B2t—25 to 37 inches; brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few roots; brown (10YR 5/3) coatings (A2) on faces of peds; thin discontinuous clay films on faces of peds and on pebbles; about 12 percent pebbles; slightly acid; gradual wavy boundary.

B31t—37 to 48 inches; brown (7.5YR 4/4) loamy sand; weak medium and coarse angular and subangular blocky structure; very friable; few roots; thin discontinuous clay films on faces of peds and on pebbles; about 11 percent pebbles; medium acid; gradual wavy boundary.

B32t—48 to 60 inches; brown (7.5YR 4/4) sandy loam; weak coarse subangular blocky structure parting to weak medium platy; friable; thin patchy clay films on faces of peds; about 13 percent pebbles; slightly acid.

Solum thickness and depth to free carbonates range from 40 to more than 60 inches. The content of cobbles and stones ranges from 15 to 35 percent. Reaction ranges from very strongly acid to neutral in the subsoil and is neutral or mildly alkaline in the substratum.

The A1 horizon ranges from 1 to 4 inches in thickness and has value of 2 or 3 and chroma of 1 or 2. Where present, the Ap horizon is fine sandy loam with value of 3 or 4 and chroma of 2 or 3. The B2ir horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 3 to 6. It is silt loam, loam, sandy loam, or fine sandy loam. Some pedons do not have a B2ir horizon. The A2 horizon has hue of 7.5YR and 10YR, value of 4 to 6, and chroma of 2 or 3. It is silt loam, loam, fine sandy loam, sandy loam, or loamy sand. Some pedons do not have an A2 horizon. The A2 part of the A&B and B&A horizons is similar to the A2 horizon. The B2t part of the A&B and B&A horizons has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 3 or 4. It is loam, fine sandy loam, or sandy loam, or gravelly counterparts of these textures. Some pedons do not have an A&B horizon. The B2t horizon has colors and textures similar to the B2t part of the A&B and B&A horizons. The B3 horizon has colors similar to the B2t horizon. It is sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy sand. The C horizon, if it occurs within a depth of 60 inches, has colors and textures similar to those of the B3 horizon.

Lorenzo Variant

The Lorenzo Variant consists of well drained, moderately over very rapidly permeable soils on outwash plains and stream terraces. These soils formed in loamy deposits underlain by calcareous stratified sand and gravel outwash. Slope ranges from 1 to 15 percent.

Lorenzo Variant soils are similar to Boyer and Rosholt soils and are adjacent to Boyer soils on the landscape. Boyer soils are similar to the Lorenzo Variant soils in position on the landscape but have thicker sola. Rosholt soils have thicker sola than Lorenzo Variant soils and are underlain by acid sand and gravel.

Typical pedon of Lorenzo Variant sandy loam, 1 to 6 percent slopes, approximately 1,320 feet north and 560 feet east of the center of sec. 21, T. 26 N., R. 17 E.

Ap—0 to 7 inches; dark brown (7.5YR 3/2) sandy loam, brown (7.5YR 4/2) dry; moderate fine and medium granular structure; very friable; many roots; about 10 percent pebbles; mildly alkaline; abrupt smooth boundary.

B2t—7 to 11 inches; reddish brown (5YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; many roots; thin discontinuous clay films on faces of peds; some dark brown (l0YR 3/3) soil in worm and root channels; about 10 percent pebbles; mildly alkaline; abrupt wavy boundary.

IIB3t—11 to 16 inches; reddish brown (5YR 5/4) gravelly sandy loam; weak fine and medium subangular blocky structure; very friable; thin discontinuous clay films on faces of peds; many roots; about 40 percent pebbles; slight effervescence; mildly alkaline; clear wavy boundary.

IIC—16 to 60 inches; brown (7.5YR 4/4) sand stratified with gravel; single grain; loose; few roots; about 40 percent pebbles; strong effervescence; mildly alkaline.

Solum thickness and depth to free carbonates range from 10 to 20 inches. Pebble content ranges from 5 to 30 percent in the upper part of the solum and 20 to 60 percent in the lower part of the solum and in the substratum. Reaction ranges from slightly acid to mildly alkaline in the subsoil and is mildly alkaline or moderately alkaline in the substratum.

The Ap horizon has value of 2 or 4 and chroma of 1 to 3. Some pedons have an A2 horizon. The B2t horizon has 7.5YR or 5YR hue, value of 3 to 5, and chroma of 4 or 5. It is loam or sandy loam. The B3t horizon has colors similar to the B2t horizon. It is loamy sand, sandy loam, gravelly sandy loam, or gravelly loamy sand. The C horizon has hue of 10YR or 7.5YR; value and chroma is 4 to 6.

Loxley series

The Loxley series consists of very poorly drained, moderately rapidly permeable soils in depressions on ground moraines and outwash plains. These soils formed in thick accumulations of organic material. Slope ranges from 0 to 2 percent.

Loxley soils are similar to Seelyeville soils and are adjacent to Cathro and Markey soils on the landscape. Seelyeville soils are less acid than the Loxley soils. Markey and Cathro soils are similar to the Loxley soils but formed in less than 51 inches of organic material over sandy or loamy deposits.

Typical pedon of Loxley mucky peat, approximately 1,200 feet south and 400 feet east of the northwest corner of sec. 11, T. 28 N., R. 12 E.

Oe1—0 to 13 inches; dark brown (7.5YR 3/2) broken face hemic material, dark reddish brown (5YR 3/2) rubbed; about 65 percent fiber, 25 percent rubbed; weak thick platy structure; few roots; herbaceous fibers; extremely acid (pH 4.1 in water, 1:1); clear wavy boundary.

Oa1—13 to 28 inches; dark reddish brown (5YR 2/2) broken face sapric material, dark reddish brown (5YR 2/2) rubbed; about 45 percent fiber, 5 percent rubbed; weak thick platy structure; herbaceous fibers; extremely acid (pH 3.9 in water, 1:1); clear wavy boundary.

Oa2—28 to 60 inches; dark reddish brown (5YR 2/2) broken face, dark reddish brown (5YR 2/2) rubbed sapric material; about 35 percent fiber, 5 percent rubbed; massive; herbaceous fibers; extremely acid (pH 3.9 in water, 1:1).

Thickness of the organic layers is greater than 51 inches. Reaction ranges from extremely acid to strongly acid in the organic layers.

The organic layers have hue of 5YR, 7.5YR, or l0YR; value of 2 to 5; and chroma of 2 to 4. The surface tier is sapric or hemic material.

Mahtomedi series

The Mahtomedi series consists of excessively drained, rapidly permeable soils on outwash plains and on ground and end moraines. These soils formed in deposits of sand and gravel. Slope ranges from 0 to 30 percent.

Mahtomedi soils are similar to Menahga and Rubicon soils and are adjacent on the landscape to Au Gres and Cromwell soils and, in an intricate pattern, to Menahga soils. Menahga soils are similar to the Mahtomedi soils in position on the landscape but contain less gravel. Rubicon soils contain less gravel. Au Gres soils are somewhat poorly drained and are in lower landscape positions in drainageways and depressions. Cromwell soils are similar to the Mahtomedi soils in position on the landscape but have a 12- to 24-inch-thick sandy loam mantle.

Typical pedon of Mahtomedi loamy sand, from an area of Mahtomedi-Menahga loamy sands, 0 to 2 percent slopes, approximately 2,600 feet east and 10 feet north of the center of sec. 20, T. 27 N., R. 15 E.

Ap—0 to 6 inches; dark brown (10YR 3/3) loamy sand, brown (10YR 4/3) dry; weak medium granular structure; very friable; common roots; about 5 percent pebbles; slightly acid; abrupt smooth boundary.

B1—6 to 15 inches; brown (7.5YR 5/4) loamy sand; weak medium subangular blocky structure; friable; few roots; about 2 percent pebbles; slightly acid; clear wavy boundary.

B21—15 to 28 inches; reddish brown (5YR 4/4) gravelly loamy sand; weak medium subangular blocky structure; very friable; few roots; about 30 percent pebbles; slightly acid; gradual wavy boundary.

B22—28 to 33 inches; reddish brown (5YR 4/4) gravelly sand; weak medium subangular blocky structure; very friable; about 35 percent pebbles; slightly acid; gradual wavy boundary.

C1—33 to 39 inches; brown (7.5YR 4/4) gravelly sand; single grain; loose; about 35 percent pebbles; slightly acid; clear wavy boundary.

C2—39 to 50 inches; brown (7.5YR 5/4) gravelly sand; single grain; loose; about 25 percent pebbles; slightly acid; clear wavy boundary.

C3—50 to 60 inches; light brown (7.5YR 6/4) gravelly sand; single grain; loose; about 25 percent pebbles; neutral.

Solum thickness ranges from 20 to 40 inches. Pebble content in the subsoil and substratum ranges from 15 to 35 percent. Reaction ranges from strongly acid to slightly acid in the solum and from strongly acid to mildly alkaline in the substratum.

The Ap horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3. The B horizon has a hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 or 6. The C horizons have hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 3 or 4.

Manawa series

The Manawa series consists of somewhat poorly drained, slowly permeable soils in basins of glacial lakes. These soils formed in silty clay loam or silty clay lacustrine deposits. Slope ranges from 0 to 3 percent. In Shawano County these soils have a slightly cooler soil temperature than is defined for the series, but this difference does not alter their usefulness and behavior.

Manawa soils are similar to Briggsville soils and are adjacent to Briggsville, Iosco, and Menominee soils on the landscape. Briggsville soils occupy higher landscape positions and are well drained. Iosco soils are similar to the Manawa soils in position on the landscape but have a 20- to 40-inch-sandy mantle. Menominee soils occupy higher landscape positions, are well drained, and have a 20- to 40-inch-thick sandy mantle.

Typical pedon of Manawa silt loam, 0 to 3 percent slopes, approximately 2,100 feet south and 30 feet east of the northwest corner of sec. 1, T. 26 N., R. 15 E.

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few roots; slightly acid; abrupt smooth boundary.

B21t—9 to 12 inches; reddish brown (5YR 4/3) silty clay loam; few fine prominent strong brown (7.5YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; firm; few roots; thin discontinuous clay films on faces of peds; dark reddish brown (5YR 3/4) coatings on faces of some peds; neutral; clear smooth boundary.

B22t—12 to 26 inches; reddish brown (5YR 4/3) silty clay; common fine distinct grayish brown (10YR 5/2) mottles; moderate fine subangular and angular blocky structure; firm; thin continuous clay films on faces of peds; few roots; mildly alkaline; clear wavy boundary.

B23t—26 to 32 inches; reddish brown (5YR 4/3) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate medium angular and subangular block structure; firm; thin discontinuous clay films on faces of peds; slight effervescence; mildly alkaline; clear wavy boundary.

C1—32 to 40 inches; reddish brown (5YR 4/4) silty clay loam; few fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—40 to 60 inches; reddish brown (5YR 4/4) silty clay loam; few fine faint reddish brown (5YR 5/3) mottles; massive; firm; strong effervescence; mildly alkaline.

Solum thickness and depth to free carbonates range from 20 to 40 inches. Reaction ranges from slightly acid to mildly alkaline in the subsoil and is mildly alkaline or moderately alkaline in the substratum.

The A horizon has value of 2 or 3 and chroma of 1 to 3. Some pedons have an A2 horizon. The B2t horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 3 or 4. The C horizon has hue of 5YR or 2.5YR, value of 3 to 5, and chroma of 3 to 6.

Markey series

The Markey series consists of very poorly drained, moderately rapidly permeable soils in drainageways and depressions on outwash plains, in basins of glacial lakes, and on ground moraines. These soils formed in organic material underlain by sandy outwash deposits. Slope ranges from 0 to 2 percent.

Markey soils are similar to Cathro soils and are adjacent to Cormant, Fordum, and Seelyeville soils. Cathro soils are underlain by loamy deposits. Cormant and Fordum soils are similar to the Markey soils in position on the landscape but do not have the 16- to 51-inch-thick organic layer. Seelyeville soils are in similar landscape positions but have an organic layer more than 51 inches thick.

Typical pedon of Markey muck, from an area of Markey and Cathro mucks, approximately 660 feet south and 1,520 feet east of the northwest corner of sec. 28, T. 27 N., R. 15 E.

Oa1—0 to 17 inches; black (10YR 2/1) broken face and rubbed sapric material; about 10 percent fibers, none rubbed; weak medium granular structure; many roots; dominantly herbaceous fibers; medium acid (pH 5.6 in water, 1:1); clear wavy boundary.

0a2—17 to 28 inches; black (N 2/0) broken face and rubbed sapric material; about 5 percent fibers, none rubbed; weak coarse subangular blocky structure; few roots; dominantly herbaceous fibers; medium acid (pH 5.7 in water, 1.1); clear smooth boundary.

IIC—28 to 60 inches; dark grayish brown (l0YR 4/2) sand; single grain; loose; medium acid.

Thickness of the organic layer ranges from 16 to 51 inches and coincides with the depth to sand. The organic layer is primarily from herbaceous plants, but it contains woody fragments in some pedons. Reaction ranges from medium acid to mildly alkaline in the organic layers and from slightly acid to moderately alkaline in the substratum.

The organic layers have hue of 5YR, 7.5YR, or 10YR; value of 2 or 3; and chroma of 0 to 3. Some pedons have as much as 10 inches of hemic material or 5 inches of fibric material in the subsurface tier. In some pedons, the organic layer immediately above the IIC horizon is as much as 50 percent mineral material by volume. The IIC horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 0 to 2.

Menahga series

The Menahga series consists of excessively drained, rapidly permeable soils generally on outwash plains. In some places, they are on ground and end moraines. These soils formed in sandy deposits. Slope ranges from 0 to 30 percent.

Menahga soils are similar to Mahtomedi and Rubicon soils and are adjacent to Au Gres and Croswell soils and to Mahtomedi soils in an intricate pattern on the landscape. Mahtomedi soils are similar to the Menahga soils in position on the landscape but contain more gravel. Au Gres, Croswell, and Rubicon soils have a subsoil horizon where organic matter and aluminum have accumulated with or without iron. Au Gres soils are in lower landscape positions in drainageways and depressions and are somewhat poorly drained. Croswell soils occupy slightly lower landscape positions than do the Menahga soils and are moderately well drained.

Typical pedon of Menahga loamy sand, 0 to 2 percent slopes, approximately 270 feet south and 900 feet west of the northeast corner of sec. 27, T. 27 N., R. 15 E.

Ap—0 to 10 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; very friable; common roots; about 3 percent pebbles; medium acid; abrupt smooth boundary.

B21—10 to 16 inches; brown (7.5YR 4/4) sand; weak fine and medium subangular blocky structure; very friable; few roots; some dark brown (10YR 3/3) soil in worm and root channels; about 3 percent pebbles; medium acid; clear wavy boundary.

B22—16 to 24 inches; strong brown (7.5YR 5/6) sand; weak coarse subangular blocky structure; very friable; about 3 percent pebbles; medium acid; clear wavy boundary.

B3—24 to 36 inches; strong brown (7.5YR 5/6) coarse sand; single grain; loose; about l2 percent pebbles; medium acid; gradual wavy boundary.

C—36 to 60 inches; brown (7.5YR 5/4) sand; single grain; loose; about 8 percent pebbles; medium acid.

Solum thickness ranges from 20 to 40 inches. Reaction ranges from very strongly acid to medium acid in the subsoil and in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The B horizon has a hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 5.

Menominee series

The Menominee series consists of well drained, rapidly over moderately permeable soils on ground moraines and in basins of glacial lakes. These soils formed in windblown sand and the underlying loamy drift. Slope ranges from 1 to 20 percent.

Menominee soils are commonly adjacent to Iosco, Onaway, and Tilleda soils. Iosco soils are in lower landscape positions in drainageways and depressions and are somewhat poorly drained. Onaway and Tilleda soils are similar to the Menominee soils in position on the landscape but do not have a 20- to 40-inch-thick sandy mantle.

Typical pedon of Menominee loamy sand, 1 to 6 percent slopes, approximately 1,760 feet west and 10 feet south of the center of sec. 21, T. 26 N., R. 16 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, brown (10YR 4/3) dry; weak fine granular structure; very friable; many roots; neutral; abrupt smooth boundary.

B21ir—8 to 13 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; few roots; slightly acid; clear wavy boundary.

B22ir—13 to 26 inches; brown (7.5YR 5/4) sand; weak medium subangular blocky structure; very friable; few roots; slightly acid; clear wavy boundary.

IIA2—26 to 30 inches; brown (7.5YR 4/2) fine sandy loam, light brown (7.5YR 6/4) dry; weak medium platy structure; very friable; few roots; about 2 percent pebbles; slightly acid; clear wavy boundary.

IIB&A—30 to 36 inches; reddish brown (5YR 4/4) clay loam (B2t); moderate medium subangular blocky structure; friable; tongues of dark brown (7.5YR 4/2) fine sandy loam (A2), light brown (7.5YR 6/4) dry, occupy about 20 percent of the horizon; weak medium platy structure; very friable; few roots; about 2 percent pebbles; neutral; clear wavy boundary.

IIB2t—36 to 46 inches; reddish brown (5YR 4/4) clay loam; moderate medium subangular blocky structure; friable; thin discontinuous clay films on faces of peds; few roots; about 2 percent pebbles; mildly alkaline; clear wavy boundary.

IIC—46 to 60 inches; reddish brown (5YR 5/4) loam; massive; friable; about 2 percent pebbles; slight effervescence; mildly alkaline.

Solum thickness ranges from 36 to 50 inches. Thickness of the sandy mantle ranges from 20 to 40 inches. Reaction ranges from strongly acid to slightly acid in the sandy mantle and from slightly acid to mildly alkaline in the loamy part of the subsoil and in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon that ranges from 1 to 4 inches thick and has value of 2 or 3 and chroma of 1 or 2. The Bir horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 or 4; and chroma of 2 to 4. The A2 horizon has value of 4 to 6 and chroma of 2 or 3. The IIBt and IIC horizons have hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 3 or 4. They are silt loam, clay loam, or loam.

Minocqua series

The Minocqua series consists of poorly drained and very poorly drained, moderately permeable over rapidly permeable soils on outwash plains. These soils formed in loamy deposits underlain by loamy sand, sand, or sand and gravel outwash. Slope ranges from 0 to 2 percent.

Minocqua soils are similar to Fordum soils and are adjacent to Cathro, Fordum, and Oesterle soils on the landscape. Fordum soils are similar to the Minocqua soils in position on the landscape but formed in recent alluvium and have no subsoil development. Cathro soils are in similar or slightly lower landscape positions but have 16 to 51 inches of organic materials overlying loamy deposits. Oesterle soils occupy slightly higher landscape positions than do the Minocqua soils and are somewhat poorly drained.

Typical pedon of Minocqua silt loam, approximately 2,140 feet north and 100 feet west of the center of sec. 3, T. 28 N., R. 11 E.

A1—0 to 5 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; many roots; slightly acid; clear smooth boundary.

B21g—5 to 10 inches; dark gray (l0YR 4/1) silt loam, few fine prominent yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; common roots; neutral; clear wavy boundary.

B22g—10 to 18 inches; gray (10YR 5/l) silt loam; common medium prominent brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; friable; few roots; about 1 percent pebbles; neutral; gradual wavy boundary.

B23g—18 to 30 inches; grayish brown (10YR 5/2) silt loam; many medium faint gray (10YR 6/1) and many coarse prominent brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; friable; about 1 percent pebbles; neutral, gradual wavy boundary.

IIB3g—30 to 34 inches; grayish brown (10YR 5/2) loam; few medium prominent brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; friable; about 2 percent pebbles; neutral; clear wavy boundary.

IIC1—34 to 43 inches; brown (10YR 5/3) loamy sand; few fine prominent yellow (10YR 7/6) mottles; single grain; loose; about 5 percent pebbles; mildly alkaline; gradual wavy boundary.

IIC2—43 to 60 inches; pale brown (10YR 6/3) loamy sand; many medium prominent brownish yellow (10YR 6/6) mottles; single grain; loose; about 5 percent pebbles; mildly alkaline.

Solum thickness ranges from 20 to 40 inches. Reaction ranges from strongly acid to neutral in the subsoil and substratum.

Some pedons have an 0 horizon. The A1 horizon has value of 2 or 3 and chroma of 0 to 2. The A2g horizon, if it occurs, has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 or 2. It is silt loam, loam, sandy loam, or fine sandy loam. The B2g horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 to 6; and chroma of 1 or 2. It is silt loam, loam, sandy loam, or fine sandy loam. The IIC horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 to 6; and chroma of 2 to 4. It is loamy sand, sand, gravelly sand, or stratified sand and gravel.

Oesterle series

The Oesterle series consists of somewhat poorly drained, moderately over rapidly permeable soils on outwash plains and stream terraces. These soils formed in loamy deposits overlying sandy and gravelly outwash. Slope ranges from 0 to 3 percent.

Oesterle soils are adjacent to Minocqua and Rosholt soils. Minocqua soils occupy lower landscape positions and are poorly drained and very poorly drained. Rosholt soils occupy higher landscape positions and are well drained.

Typical pedon of Oesterle loam, 0 to 3 percent slopes, approximately 90 feet south and 130 feet west of the northeast corner of sec. 34, T. 26 N., R. 11 E.

Ap—0 to 9 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; moderate fine and very fine subangular blocky structure; friable; common roots; common pores; about 5 percent pebbles; medium acid; abrupt smooth boundary.

A&B—9 to 15 inches; brown (7.5YR 5/2) loam (A2), very pale brown (10YR 7/3) dry; moderate medium platy structure; friable; occupies about 70 percent of the horizon as tongues extending into or surrounding dark brown (7.5YR 4/4) loam (B2t); common fine distinct yellowish red (5YR 5/6), common fine and prominent yellowish red (5YR 5/8), and few fine distinct grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; friable; common roots; common pores; thin patchy clay films on faces of peds and clay bridging between sand grains (Bt); about 10 percent pebbles; strongly acid; clear wavy boundary.

B&A—15 to 23 inches; dark brown (7.5YR 4/4) loam (B2t); common coarse distinct yellowish red (5YR 5/6), common coarse prominent yellowish red (5YR 5/8), and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure parting to weak thin platy; friable; occupies about 70 percent of the horizon; tongues and interfingers of brown (7.5YR 5/2) loam (A2) very pale brown (10YR 7/3) dry; moderate thin platy structure; friable; common roots; common pores; thin patchy clay films on faces of peds and clay bridging of sand grains (B2t); about 10 percent pebbles; very strongly acid; abrupt wavy boundary.

IIB3t—23 to 27 inches; reddish brown (5YR 4/4) gravelly loamy sand; common fine distinct yellowish red (5YR 5/6), common fine prominent yellowish red (5YR 5/8), and few fine distinct grayish brown (10YR 5/2) mottles; weak medium and fine subangular blocky structure; very friable; few roots; some clay bridging between sand grains; about 30 percent pebbles; strongly acid; clear wavy boundary.

IIC1—27 to 34 inches; strong brown (7.5YR 5/6) gravelly sand; few medium faint yellowish red (5YR 5/6) mottles; single grain; loose; about 35 percent pebbles; strongly acid; gradual wavy boundary.

IIC2—34 to 52 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; about 2 percent pebbles; strongly acid; clear wavy boundary.

IIC3—52 to 60 inches; yellowish brown (10YR 5/6) stratified loamy sand and loamy fine sand; common coarse faint strong brown (7.5YR 5/6) mottles; massive; very friable; about 2 percent pebbles; strongly acid.

Solum thickness ranges from 20 to 40 inches. Thickness of the loamy mantle ranges from 20 to 36 inches. Reaction ranges from very strongly acid to slightly acid in the subsoil and from strongly acid to slightly acid in the substratum. Content of coarse fragments ranges from 5 to 20 percent in the solum and from 10 to 50 percent in the substratum.

The Ap horizon has value and chroma of 2 or 3. Uncultivated pedons have an A1 horizon 1 to 4 inches thick with value of 2 or 3 and chroma of 1 or 2. Some pedons have an A2 horizon. The A2 part of the A&B and B&A horizons has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is sandy loam or loam. The B2t part of the A&B and B&A horizons has hue of 10YR or 7.5YR and value and chroma of 4 or 5. It is sandy loam or loam. Some pedons do not have either the A&B or B&A horizon and some have a B2t horizon. The IIB3t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The IIC horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 6. It is sand and gravel, sand, loamy sand, or loamy fine sand and is stratified.

Onaway series

The Onaway series consists of well drained and moderately well drained, moderately permeable soils on ground moraines. These soils formed in calcareous loamy glacial till. Slope ranges from 1 to 35 percent. In Shawano County, most cultivated pedons do not have the spodic horizon as defined for the series, but this difference does not alter their usefulness and behavior.

Onaway soils are similar to Tilleda soils and are commonly adjacent to Fairport and Solona soils on the landscape. Tilleda soils have thicker sola and are deeper over carbonates. Fairport soils are similar to the Onaway soils in position on the landscape but are underlain by dolomite at depths of 20 to 40 inches. Solona soils are somewhat poorly drained and occupy lower landscape positions in drainageways and depressions.

Typical pedon of Onaway fine sandy loam, 2 to 6 percent slopes, approximately 150 feet south and 250 feet west of the northeast corner of sec. 25, T. 25 N., R. 17 E.

Ap—0 to 9 inches; dark brown (7.5YR 3/2) fine sandy loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure parting to moderate fine granular; friable; many roots; mildly alkaline; abrupt smooth boundary.

A&B—9 to 15 inches; brown (7.5YR 5/2) fine sandy loam (A2); weak medium platy structure; friable; occupies about 75 percent of the horizon and surrounds remnants of dark reddish brown (5YR 3/4) clay loam (Bt); strong medium subangular blocky structure; firm; common roots; thin patchy clay films on faces of peds (Bt); about 3 percent pebbles; mildly alkaline; clear wavy boundary.

B2t—15 to 23 inches; dark reddish brown (5YR 3/4) loam; strong medium subangular blocky structure; firm; common roots; thick discontinuous clay films on faces of peds; about 5 percent pebbles; mildly alkaline; gradual wavy boundary.

B3t—23 to 28 inches; dark reddish brown (5YR 3/4) loam; moderate medium subangular blocky structure; friable; common roots; thin discontinuous clay films on faces of peds; about 5 percent pebbles; mildly alkaline; clear wavy boundary.

C—28 to 60 inches; dark brown (7.5YR 4/4) sandy loam; massive; friable; about 5 percent pebbles; strong effervescence; moderately alkaline.

Solum thickness and depth to free carbonates range from 15 to 30 inches. Reaction ranges from medium acid to mildly alkaline in the solum and is mildly alkaline or moderately alkaline in the substratum.

The Ap horizon has value of 2 or 3 and chroma of 3 or 4. Some pedons have an A1 horizon 1 to 4 inches thick with value of 2 or 3 and chroma of 1 or 2. Some pedons also have an A2 horizon or a Bir horizon. Some have both. The A2 part of the A&B and B&A horizons has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is loam or fine sandy loam. The Bt part of the A&B and B&A horizons has colors and textures similar to the B2t horizon. The B2t horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. It is loam or clay loam. The B3t horizon has colors similar to the B2t horizon and is loam or sandy loam. The C horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 to 7; and chroma of 3 or 4. It is sandy loam or loam. In some pedons it is 15 to 40 percent cobbles. Some pedons have high-chroma mottles in the lower part of the soil.

Plover series

The Plover series consists of somewhat poorly drained, moderately permeable soils in basins of glacial lakes. These soils formed in stratified loamy and sandy lacustrine deposits. Slope ranges from 0 to 3 percent.

Plover soils are similar to Oesterle soils and are adjacent to Alban, Minocqua, Oesterle, and Rosholt soils on the landscape. Oesterle soils are similar to the Plover soils in position on the landscape but are underlain by sandy and gravelly outwash. Alban soils occupy higher landscape positions and are moderately well drained. Minocqua soils occupy lower landscape positions, are poorly drained and very poorly drained, and are underlain by sandy and gravelly outwash. Rosholt soils occupy higher landscape positions, are well drained, and are underlain by sandy and gravelly outwash.

Typical pedon of Plover loam, 0 to 3 percent slopes, approximately 100 feet west and 1,100 feet north of the center of sec. 25, R. 28 N., R. 12 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) loam, brown (10YR 6/3) dry; moderate medium granular structure; friable; many roots; medium acid; abrupt smooth boundary.

Bir—8 to 10 inches; brown (7.5YR 5/4) fine sandy loam; few fine prominent reddish yellow (7.5YR 6/8) mottles; weak fine subangular blocky structure; very friable; common roots; strongly acid; clear wavy boundary.

A2—10 to 14 inches; pinkish gray (7.5YR 6/2) fine sandy loam, pinkish gray (7.5YR 7/2) dry; common medium prominent reddish yellow (7.5YR 6/8) mottles; weak medium subangular blocky structure parting to weak medium platy; very friable; common roots; strongly acid; gradual wavy boundary.

A&B—14 to 20 inches; pinkish gray (7.5YR 6/2) fine sandy loam (A2), pinkish gray (7.5YR 7/2) dry; many medium prominent reddish yellow (7.5YR 6/8) and few fine faint pinkish gray (7.5YR 7/2) mottles; moderate medium subangular blocky structure; very friable; occupies about 70 percent of the horizon and extends as tongues into or completely surrounds remnants of brown (7.5YR 5/4) fine sandy loam (Bt); common medium distinct reddish yellow (7.5YR 6/8) mottles; moderate medium subangular blocky structure; very friable; few roots; thin patchy clay films on faces of peds (Bt); strongly acid; gradual wavy boundary.

B&A—20 to 26 inches; brown (7.5YR 5/4) fine sandy loam (Bt); many medium prominent reddish yellow (7.5YR 6/8) and few fine distinct light gray (10YR 7/2) mottles; moderate medium subangular blocky structure; friable; tongues of pinkish gray (7.5YR 6/2) fine sandy loam (A2), pinkish gray (7.5YR 7/2) dry, penetrate the horizon from above and occupy about 30 percent of the volume; moderate medium subangular blocky structure; very friable; few roots; thin patchy clay films on faces of peds (Bt); strongly acid; clear wavy boundary.

B2t—26 to 32 inches; brown (7.5YR 4/4) sandy loam; many medium prominent strong brown (7.5YR 5/8) and few medium prominent pinkish gray (7.5YR 7/2) mottles; moderate medium subangular blocky structure; friable; thin discontinuous clay films; few roots; medium acid; gradual wavy boundary.

B3—32 to 36 inches; brown (7.5YR 4/4) loamy sand; many medium prominent strong brown (7.5YR 5/8) and light gray (10YR 7/2) mottles; weak medium subangluar blocky structure; very friable; medium acid; clear wavy boundary.

C1—36 to 50 inches; light brown (7.5YR 6/4) very fine sand; many medium prominent strong brown (7.5YR 5/8) and many medium distinct light gray (10YR 7/2) mottles; massive; friable; slightly acid; clear wavy boundary.

C2—50 to 60 inches; yellowish red (5YR 4/6) silt loam; massive; friable; thin strata of fine sand; neutral.

Solum thickness ranges from 30 to 40 inches. Reaction ranges from very strongly acid to medium acid in the subsoil and from medium acid to neutral in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 4 inches thick with value of 2 or 3 and chroma of 1 or 2. Bir horizons have value of 4 or 5 and chroma of 3 or 4. Some pedons do not have a Bir horizon. The A2 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. It is fine sandy loam, sandy loam, very fine sandy loam, silt loam, or loamy fine sand. The A2 part of the A&B and B&A horizons has colors and textures similar to the A2 horizon. The Bt part of the A&B and B&A horizons has colors and textures similar to the B2t horizon. The B2t and B3 horizons have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 or 5. They are loamy sand, sandy loam, fine sandy loam, very fine sandy loam, and silt loam. The C horizon has hue of 5YR, 7.5YR, or 10YR with value and chroma of 4 to 6. It is silt, silt loam, very fine sand, or fine sand and has thin strata of loam, sandy loam, and loamy sand.

Rosholt series

The Rosholt series consists of well drained, moderately rapidly over very rapidly permeable soils on outwash plains and stream terraces. These soils formed mostly in loamy drift and are underlain by sandy and gravelly outwash. Slope ranges from 0 to 35 percent.

Rosholt soils are similar to Alban and Kennan soils and are adjacent to Alban, Cromwell, Kennan, and Oesterle soils on the landscape. Alban soils are similar to the Rosholt soils in position on the landscape but formed in stratified loamy lacustrine deposits. Kennan soils are on moraines and drumlins and formed in sandy loam or loamy sand glacial till. Cromwell soils are similar to the Rosholt soils in position on the landscape but have a thinner loamy mantle and no horizon of clay accumulation in the subsoil. Oesterle soils are somewhat poorly drained and are in lower landscape positions in drainageways and depressions.

Typical pedon of Rosholt fine sandy loam, 2 to 6 percent slopes, approximately 1,100 feet south and 1,000 feet west of the northeast corner of sec. 1, T. 28 N., R. 12 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) fine sandy loam, pale brown (10YR 6/3) dry; weak very fine subangular blocky structure; friable; many roots; about 2 percent pebbles; medium acid; abrupt smooth boundary.

A2—8 to 13 inches; brown (10YR 5/3) fine sandy loam, light gray (10YR 7/2) dry; weak thin platy structure; friable; common roots; about 5 percent pebbles; medium acid; clear wavy boundary.

B&A—13 to 20 inches; dark brown (7.5YR 4/4) fine sandy loam (B2t); moderate fine subangular blocky structure; friable; thin patchy clay films on faces of peds (Bt); occupies about 70 percent of the horizon and is penetrated by tongues of brown (10YR 5/3) fine sandy loam (A2), light gray (10YR 7/2) dry; weak medium platy structure; friable; few roots; about 10 percent pebbles; strongly acid; clear wavy boundary.

B2t—20 to 28 inches; dark brown (7.5YR 4/4) sandy loam; moderate fine and medium subangular blocky structure; friable; brown (10YR 5/3) coatings (A2) on vertical faces of peds; thin discontinuous clay films on faces of peds; few roots; about 10 percent pebbles; strongly acid; abrupt wavy boundary.

IIB3—28 to 34 inches; brown (7.5YR 5/4) gravelly loamy sand; weak medium subangular blocky structure; very friable; about 25 percent pebbles; strongly acid; clear wavy boundary.

IIC1—34 to 52 inches; brown (7.5YR 5/4) sand and gravel; single grain; loose; about 25 percent pebbles; strongly acid; abrupt wavy boundary.

IIC2—52 to 60 inches; yellowish brown (10YR 5/4) stratified coarse and medium sand; single grain; loose; about 2 percent pebbles; strongly acid.

Solum thickness ranges from 20 to 40 inches and extends into the underlying sand and gravel. The content of coarse fragments ranges from 0 to 15 percent in the upper part of the solum, 10 to 35 percent in the lower part of the solum, and 2 to 60 percent in the substratum. Reaction ranges from strongly acid to slightly acid in the subsoil and substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon 3 or 4 inches thick with value of 2 or 3 and chroma of 1 or 2. Some pedons have an horizon with color similar to the Bir horizon, but without the chemical properties. The A2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is loamy sand, fine sandy loam, sandy loam, loam, or silt loam. Some pedons do not have an A2 horizon. The A2 part of the B&A horizon is like the A2 horizon described above. The B2t part of the B&A horizon has hue of l0YR or 7.5YR, value of 4 or 5; and chroma of 3 or 4. It is fine sandy loam, sandy loam, loam, or silt loam. Some pedons have an A&B horizon and do not have the B&A horizon; some have both. The B2t horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam, loam, or sandy loam. The IIB3 horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam. The IIC horizon has hue of 10YR or 7.5YR and value and chroma of 3 to 6.

Rosholt Variant

The Rosholt series consists of moderately deep, well drained, moderately permeable soils on rocky knolls and ground moraines associated with rock knobs. These soils formed in loamy deposits overlying granite bedrock at a depth of 20 to 40 inches. Slope ranges from 2 to 35 percent.

Rosholt Variant soils are adjacent to Minocqua, Oesterle, and Rosholt soils and to Rock outcrop in an intricate pattern on the landscape. These adjacent soils do not have granitic bedrock within a depth of 60 inches but have a substratum of loamy sand, sand, or sand and gravel. Minocqua soils occupy lower landscape positions in drainageways and depressions and are poorly drained and very poorly drained. Oesterle soils are in lower landscape positions in drainageways and depressions and are somewhat poorly drained. Rosholt soils are similar to the Rosholt Variant soils in position on the landscape but have an horizon of clay accumulation in the subsoil. Rock outcrop, which is exposed granite bedrock, occupies similar landscape positions.

Typical pedon of Rosholt Variant silt loam, from an area of Rock outcrop-Rosholt Variant complex, 2 to 35 percent slopes, approximately 1,460 feet north and 925 feet west of the center of sec. 27, T. 26 N., R. 12 E.

A1—0 to 2 inches; very dark brown (10YR 2/2) silt loam; weak fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.

A2—2 to 4 inches; dark reddish gray (5YR 4/2) silt loam; weak thick platy structure; friable; common roots; very strongly acid; abrupt wavy boundary.

B21ir—4 to 12 inches; dark reddish brown (5YR 3/4) silt loam; moderate very fine subangular blocky structure; friable; few roots; very strongly acid; gradual wavy boundary.

B22ir—12 to 22 inches; dark brown (7.5YR 4/4) silt loam; moderate very fine subangular blocky structure; friable; few roots; about 5 percent granitic pebbles; very strongly acid; abrupt smooth boundary.

R—22 inches; granitic bedrock.

Solum thickness and depth to granitic bedrock range from 20 to 40 inches. The content of granitic cobbles ranges from 0 to 10 percent and the content of pebbles ranges from 0 to 7 percent throughout the pedon. Reaction ranges from very strongly acid to slightly acid throughout.

The A1 horizon is 1 or 2 inches thick with hue of 5YR, 7.5YR, or 10YR; value of 2 or 3; and chroma of 1 or 2. The A2 horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 2. It is loam, silt loam, or sandy loam. Some pedons do not have an A2 horizon. The B21ir horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 3 or 4; and chroma of 3 or 4. It is loam, silt loam, or sandy loam. The B22ir horizon has hue of 5YR or 7.5YR and value of 4 or 5. It is loam, silt loam, or sandy loam. Some pedons have a B3 horizon, and some have a IIC horizon.

Rousseau series

The Rousseau series consists of moderately well drained, rapidly permeable soils on outwash plains and basins of glacial lakes. These soils formed in sandy outwash and windblown deposits. Slope ranges from 0 to 6 percent.

Rousseau soils are similar to Croswell, Menahga, and Shawano soils and are adjacent to Shawano and Wainola soils on the landscape. Croswell soils are less than 50 percent fine sand. Menahga soils are excessively drained and are less than 50 percent fine sand. Shawano soils are similar to, or slightly higher than, the Rousseau soils in position on the landscape and are excessively drained. Wainola soils are in lower landscape positions in drainageways and depressions and are somewhat poorly drained.

Typical pedon of Rousseau loamy fine sand, 2 to 6 percent slopes, approximately 45 feet north and 2,020 feet west of the southeast corner of sec. 19, T. 27 N., R. 16 E.

Ap—0 to 12 inches; dark brown (10YR 3/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; very friable; many roots; some strong brown (7.5YR 5/6) soil mixed in by plowing; strongly acid; abrupt smooth boundary.

B2ir—12 to 16 inches; dark brown (7.5YR 4/4) fine sand; weak medium and coarse subangular blocky structure; very friable; common roots; strongly acid; gradual wavy boundary.

B31ir—16 to 25 inches; strong brown (7.5YR 5/8) fine sand; weak medium and coarse subangular blocky structure; very friable; few roots; strongly acid; clear wavy boundary.

B32—25 to 33 inches; brown (7.5YR 5/4) fine sand; few medium distinct strong brown (7.5YR 5/6) mottles; weak medium and coarse subangular blocky structure; very friable; medium acid; clear wavy boundary.

C1—33 to 47 inches; brown (7.5YR 5/3) fine sand; common medium prominent yellowish red (5YR 5/8) mottles; single grain; loose; medium acid; gradual wavy boundary.

C2—47 to 60 inches; brown (7.5YR 5/3) fine sand; few medium prominent yellowish red (5YR 5/8) mottles; single grain; loose; medium acid.

Solum thickness ranges from 20 to 32 inches. Reaction ranges from very strongly acid to medium acid in the subsoil and is medium acid or slightly acid in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon that ranges from 1 to 4 inches thick and has value of 2 or 3 and chroma of 0 to 2. Some pedons have an A2 horizon. The B2ir horizon has hue of 5YR or 7.5YR and value and chroma of 4 to 6. The B3 horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 6 to 8. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 to 6.

Rubicon series

The Rubicon series consists of excessively drained, rapidly permeable soils on outwash plains and stream terraces. These soils formed in thick deposits of sand. Slope ranges from 1 to 20 percent.

Rubicon soils are similar to Menahga soils and are adjacent to Au Gres and Croswell soils on the landscape. Menahga soils do not have an horizon where organic matter and aluminum have accumulated with or without iron. Au Gres soils are in lower landscape positions in drainageways and depressions and are somewhat poorly drained. Croswell soils are similar to, or slightly lower than, the Rubicon soils in position on the landscape and are moderately well drained.

Typical pedon of Rubicon sand, 1 to 6 percent slopes, approximately 1,960 feet south and 650 feet west of the center of sec. 21, T. 28 N., R. 14 E.

A1—0 to 1 inches; very dark brown (10YR 2/2) sand, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.

A2—1 to 4 inches; brown (7.5YR 4/2) sand, brown (7.5YR 5/2) dry; weak medium platy structure; very friable; many roots; medium acid; abrupt wavy boundary.

B21ir—4 to 10 inches; dark reddish brown (5YR 3/4) sand; weak coarse subangular blocky structure; very friable; common roots; strongly acid; clear wavy boundary.

B22ir—10 to 17 inches; reddish brown (5YR 4/4) sand; weak medium subangular blocky structure; very friable; common roots; strongly acid; clear wavy boundary.

B3—17 to 28 inches; reddish brown (5YR 4/4) sand; single grain; loose; few roots; strongly acid; gradual wavy boundary.

C1—28 to 36 inches; strong brown (7.5YR 5/6) sand; single grain; loose; medium acid; clear wavy boundary.

C2—36 to 60 inches; brown (7.5YR 5/4) sand; single grain; loose; medium acid.

Solum thickness ranges from 18 to 36 inches. The content of coarse fragments ranges from 0 to 5 percent throughout the pedon. Reaction ranges from very strongly acid to medium acid in the subsoil and from strongly acid to slightly acid in the substratum.

The A1 horizon ranges from 1 to 3 inches thick and has value of 2 or 3 and chroma of 1 or 2. Some pedons have an Ap horizon that has value of 3 or 4 and chroma of 2 or 3. The A2 horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. B21ir horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. The B22ir horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. The B3 horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 4 to 6. The C horizon has hue of 7.5YR or 5YR with value and chroma of 4 to 6.

Salter Variant

The Salter Variant consists of moderately well drained and well drained, moderately permeable soils in basins of glacial lakes. These soils formed in calcareous, stratified loamy lacustrine deposits. Slope ranges from 0 to 12 percent.

Salter Variant soils are similar to Alban soils and adjacent to Bach and Shiocton soils on the landscape. Alban soils formed in noncalcareous, stratified loamy lacustrine deposits. Bach and Shiocton soils are in lower landscape positions in drainageways and depressions. Bach soils are poorly drained and very poorly drained. Shiocton soils are somewhat poorly drained.

Typical pedon of Salter Variant very fine sandy loam, 2 to 6 percent slopes, approximately 325 feet north and 775 feet east of the southwest corner of sec. 32, T. 25 N., R. 17 E.

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

A&B—8 to 12 inches; brown (10YR 4/3) very fine sandy loam (A2), very pale brown (10YR 7/3) dry; weak very thick platy structure parting to moderate medium and fine subangular blocky; very friable; remnants of dark brown (7.5YR 4/4) very fine sandy loam (Bt) occupy about 20 percent of the horizon; moderate medium and fine subangular blocky structure; friable; few roots; thin patchy clay films on faces of peds (Bt); neutral; abrupt smooth boundary.

B2t—12 to 26 inches; dark brown (7.5YR 4/4) very fine sandy loam; moderate medium subangular blocky structure; friable; thin discontinuous clay films on faces of peds; neutral; clear smooth boundary.

B3—26 to 31 inches; dark yellowish brown (10YR 4/4) very fine sandy loam; few fine prominent strong brown (7.5YR 5/8) mottles; weak thick platy structure parting to weak fine subangular blocky; very friable; slight effervescence; mildly alkaline; clear smooth boundary.

C1—31 to 57 inches; light yellowish brown (10YR 6/4) silt loam; many coarse prominent yellowish brown (10YR 5/8) mottles; massive with tendency to part along horizontal planes; very friable; thin strata of silt and very fine sand; some very pale brown (10YR 8/4) accumulations of calcium carbonate; violent effervescence; mildly alkaline; clear smooth boundary.

C2—57 to 60 inches; light yellowish brown (10YR 6/4) stratified very fine sand and silt; many medium distinct strong brown (7.5YR 5/6) mottles; massive with tendency to part along horizontal planes; very friable; violent effervescence; mildly alkaline.

Solum thickness ranges from 24 to 40 inches. Reaction ranges from neutral to moderately alkaline in the subsoil and is mildly alkaline or moderately alkaline in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon that ranges from 1 to 4 inches thick and has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has value of 4 to 6 and chroma of 2 or 3. It is loam, silt loam, fine sandy laom, or very fine sandy loam. Some pedons do not have an A2 horizon. Some pedons do not have an A&B horizon, and some pedons have a B&A horizon. The A2 part of the A&B horizon has color and texture similar to the A2 horizon. The Bt part of the A&B horizon has color and texture similar to the B2t horizon. The B2t horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 to 6; and chroma of 3 to 6. It is silt loam, loam, very fine sandy loam, or fine sandy loam. The C horizon has hue of 7.5YR or l0YR, value of 4 to 6, and chroma of 3 to 6.

Scott Lake series

The Scott Lake series consists of moderately well drained, moderately over very rapidly permeable soils on outwash plains and stream terraces. These soils formed in loamy drift underlain by stratified sand and gravel outwash. Slope ranges from 0 to 3 percent.

Scott Lake soils are similar to Brill soils and are near Oesterle and Rosholt soils on the landscape. Brill soils have more silt and clay in the subsoil. Oesterle soils are in lower landscape positions in drainageways and depressions and are somewhat poorly drained. Rosholt soils are similar to, or slightly higher than, the Scott Lake soils in position on the landscape and are well drained and have less silt in the upper part of the subsoil.

Typical pedon of Scott Lake loam, 0 to 3 percent slopes, approximately 680 feet south and 1,100 feet west of the center of sec. 12, T. 29 N., R. 11 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; weak very fine subangular blocky structure; friable; many roots; about 4 percent pebbles; medium acid; abrupt smooth boundary.

A2—9 to 12 inches; brown (10YR 5/3) loam, very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure parting to weak medium platy; friable; common roots; about 4 percent pebbles; some very dark grayish brown (10YR 3/2) soil in worm and root channels; slightly acid; clear wavy boundary.

A&B—12 to 15 inches; brown (10YR 5/3) loam (A2), very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure parting to weak thin platy; friable; occupies approximately 70 percent of the horizon, extending as tongues into dark brown (7.5YR 4/4) loam (Bt); moderate medium subangular blocky structure; friable; common roots; thin patchy clay films on faces of peds (Bt); about 4 percent pebbles; medium acid; clear wavy boundary.

B&A—15 to 21 inches; dark brown (7.5YR 4/4) loam (Bt); occupies about 70 percent of the horizon; moderate medium and coarse subangular blocky structure; friable; penetrated from above by tongues of brown (10YR 5/3) loam (A2), very pale brown (10YR 7/3) dry; moderate medium and coarse subangular blocky structure; friable; common roots; thin discontinuous clay films on faces of peds (Bt); about 4 percent pebbles; strongly acid; clear wavy boundary.

B2t—21 to 28 inches; dark brown (7.5YR 4/4) loam; common fine and medium distinct strong brown (7.5YR 5/6) mottles; moderate medium and coarse subangular blocky structure; friable; few roots; thin discontinuous clay films on faces of peds; coatings (A2) of brown (10YR 5/3) on some vertical faces of peds; about 4 percent pebbles; very strongly acid; abrupt smooth boundary.

IIB3t—28 to 31 inches; dark brown (7.5YR 4/4) sandy loam; common fine distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; very friable; few roots; thin patchy clay films on faces of peds; about 10 percent pebbles; very strongly acid; clear wavy boundary.

IIC1—31 to 40 inches; brown (7.5YR 5/4) gravelly loamy sand; few medium distinct strong brown (7.5YR 5/6) mottles; single grain; loose; about 20 percent pebbles; very strongly acid; abrupt wavy boundary.

IIC2—40 to 60 inches; brown (7.5YR 5/4) gravelly coarse sand with thin strata of medium sand; single grain; loose; about 20 percent pebbles; strongly acid.

Solum thickness ranges from 24 to 40 inches. Thickness of the loamy mantle ranges from 20 to 36 inches. Reaction ranges from very strongly acid to slightly acid in the solum and from very strongly acid to neutral in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon that ranges from 1 to 4 inches thick and has value of 2 or 3 and chroma of 1 or 2. Some pedons have an horizon that has colors similar to a Bir horizon but without the chemical properties. The A2 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. It is loam, silt loam, or fine sandy loam. Some pedons do not have an A2 horizon. The A2 part of the A&B and B&A horizons has colors and textures similar to the A2 horizon. The Bt part of the A&B and B&A horizons has colors and textures similar to the B2t horizon. Some pedons do not have an A&B horizon. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam, sandy loam, or silt loam. The IIB3t horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 3 to 6. It is sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy sand. The IIC horizon has hue of 5YR, 7.5YR, or 10YR; value of 5 or 6; and chroma of 4 to 8.

Seelyeville series

The Seelyeville series consists of very poorly drained, moderately rapidly permeable soils in depressional areas on ground moraines and outwash plains. These soils formed in thick accumulations of organic material. Slope ranges from 0 to 2 percent.

Seelyeville soils are similar to Loxley soils and are adjacent to Angelica, Cathro, Loxley, Markey, and Minocqua soils. All these soils occupy similar positions on the landscape. Loxley soils are more acid. Angelica and Minocqua soils typically do not have an organic surface layer, but where they do it is less than 16 inches thick. Cathro soils have loamy deposits at a depth of 16 to 50 inches. Markey soils have sandy deposits at a depth of 16 to 50 inches.

Typical pedon of Seelyeville muck, approximately 30 feet north and 20 feet east of the southwest corner of sec. 33, T. 28 N., R. 12 E.

Oa1—0 to 6 inches; very dark brown (10YR 2/2) broken face and rubbed sapric material; about 60 percent fiber, 12 percent rubbed; moderate fine granular structure; many roots; primarily herbaceous fibers and about 20 percent woody fragments; strongly acid (pH 5.1 in water, 1:1); clear smooth boundary.

Oa2—6 to 16 inches; black (10YR 2/1) broken face, sapric material, very dark brown (10YR 2/2) rubbed; about 20 percent fiber, 2 percent rubbed; weak thick platy structure; few roots; primarily herbaceous fibers and about 10 percent woody fragments; medium acid (pH 5.7 in water, 1:1); gradual wavy boundary.

Oa3—16 to 26 inches; very dark grayish brown (10YR 3/2) broken face and rubbed sapric material; about 50 percent fiber, 10 percent rubbed; weak coarse platy structure; primarily herbaceous fibers and about 30 percent woody fragments; slightly acid (pH 6.1 in water, 1:1); gradual wavy boundary.

Oa4—26 to 47 inches; dark brown (10YR 3/3) broken face sapric material, very dark brown (10YR 2/2) rubbed sapric material; about 50 percent fiber, 10 percent rubbed; massive; primarily herbaceous fibers; medium acid (pH 6.1 in water, 1:1); clear wavy boundary.

Oa5—47 to 60 inches; black (10YR 2/1) broken face and rubbed sapric material; about 15 percent fiber, 2 percent rubbed; massive; primarily herbaceous fibers; slightly acid (pH 6.3 in water, 1:1).

Thickness of organic layer is greater than 51 inches. Reaction ranges from medium acid to neutral.

The organic layer has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. The surface tier is mostly sapric material, but it is hemic material in some pedons. In some pedons, the subsurface and bottom tiers contain up to 10 inches of hemic material.

Shawano series

The Shawano series consists of excessively drained, rapidly permeable soils on outwash plains, in basins of glacial lakes, and on stream terraces. These soils formed in sandy outwash or sandy lacustrine deposits. Slope ranges from 1 to 20 percent.

Shawano soils are similar to Menahga, Rousseau, and Croswell soils and are adjacent to Rousseau and Wainola soils on the landscape. Menahga and Croswell soils are less than 50 percent fine sands, and Croswell soils are moderately well drained. Rousseau soils are similar to, or slightly lower than, the Shawano soils in position on the landscape and are moderately well drained. Wainola soils are in lower landscape positions in drainageways and depressions and are somewhat poorly drained.

Typical pedon of Shawano loamy fine sand, 1 to 6 percent slopes, approximately 575 feet west and 100 feet south of the northeast corner of sec. 7, T. 26 N., R. 16 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) loamy fine sand, light brownish gray (10YR 6/2) dry; weak fine and medium subangular blocky structure; very friable; many roots; strongly acid; abrupt smooth boundary.

B21—8 to 13 inches; strong brown (7.5YR 5/6) fine sand; single grain; loose; many roots; strongly acid; gradual wavy boundary.

B22—13 to 34 inches; strong brown (7.5YR 5/6) fine sand; single grain; loose; few roots; strongly acid; clear wavy boundary.

C—34 to 60 inches; reddish yellow (7.5YR 6/6) fine sand; single grain; loose; few roots; medium acid.

Solum thickness ranges from 18 to 36 inches. The solum and substratum are dominantly fine sand. Reaction ranges from strongly acid to slightly acid in the subsoil and from medium acid to mildly alkaline in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon that ranges from 1 to 4 inches thick and has value and chroma of 2 or 3. The B horizon has value of 4 or more and chroma of 4 to 6. The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 3 to 6.

Shiocton series

The Shiocton series consists of somewhat poorly drained, moderately permeable soils in basins of glacial lakes. These soils formed in stratified silty, loamy, and sandy lacustrine deposits. Slope ranges from 0 to 3 percent.

Shiocton soils are similar to Bach soils and are adjacent to Bach, Salter Variant, and Solona soils on the landscape. Bach soils are in lower positions in the landscape and are poorly drained and very poorly drained. Salter Variant soils are in higher positions in the landscape and are well drained and moderately well drained. Solona soils are similar to the Shiocton soils in position on the landscape but formed in loamy glacial till.

Typical pedon of Shiocton silt loam, 0 to 3 percent slopes, approximately 1,050 feet east and 65 feet north of the southwest corner of sec. 32, T. 25 N., R. 17 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B2—10 to 15 inches; brown (10YR 5/3) silt loam; few fine prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; many very dark grayish brown (10YR 3/2) worm casts; slight effervescence; mildly alkaline; clear smooth boundary.

B3—15 to 26 inches; brown (10YR 5/3) very fine sandy loam; many coarse prominent strong brown (7.5YR 5/6) and few fine distinct gray (5Y 6/1) mottles; weak thick platy structure parting to weak fine subangular blocky; very friable; violent effervescence; mildly alkaline; clear smooth boundary.

C1—26 to 30 inches; brown (10YR 5/3) very fine sandy loam; many coarse prominent strong brown (7.5YR 5/6) and few fine distinct gray (5Y 6/1) mottles; massive but parts along horizon planes; very friable; violent effervescence; mildly alkaline; clear smooth boundary.

C2—30 to 60 inches; variegated light brown (7.5YR 6/4), strong brown (7.5YR 5/8), brown (10YR 5/3), and gray (5YR 6/1), stratified silt loam and very fine sand; massive but parts along horizon planes; very friable; strong effervescence; mildly alkaline.

Solum thickness ranges from 16 to 36 inches. Thickness of the mollic epipedon ranges from 8 to 15 inches. Reaction is neutral or mildly alkaline in the subsoil and is mildly alkaline or moderately alkaline in the substratum.

The Ap or A1 horizon has value of 2 or 3 and chroma of 1 to 3. Some pedons have an A12 or A3 horizon. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is very fine sandy loam or silt loam. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 to 6. It is stratified with layers of silt, silt loam, loam, very fine sandy loam, fine sandy loam, or very fine sand.

Shiocton Variant

The Shiocton Variant consists of somewhat poorly drained, moderately permeable soils on ground moraines. These soils formed in loamy drift underlain by cobbly silt loam and cobbly loam glacial till. Slope ranges from 0 to 3 percent.

The Shiocton Variant soils are similar to Solona soils and are commonly adjacent to Onaway, cobbly substratum, soils on the landscape. Solona soils are similar to the Shiocton Variant soils in position on the landscape but have fewer cobbles. Onaway, cobbly substratum, soils are in higher positions on the landscape and are well drained.

Typical pedon of Shiocton Variant silt loam, 0 to 3 percent slopes, approximately 10 feet east and 500 feet north of the southwest corner of sec. 7, T. 26 N., R. 17 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many roots; mildly alkaline; abrupt smooth boundary.

B2—8 to 16 inches; brown (10YR 5/3) silt loam; common medium prominent strong brown (7.5YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few roots; mildly alkaline; clear wavy boundary.

B3—16 to 22 inches; brown (10YR 5/3) very fine sandy loam; common medium prominent strong brown (7.5YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; weak coarse angular blocky structure; friable; few roots; slight effervescence; moderately alkaline; clear wavy boundary.

IIC1—22 to 33 inches; brown (10YR 5/3) cobbly silt loam; common medium prominent strong brown (7.5YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; massive; friable; about 15 percent cobbles; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC2—33 to 60 inches; brown (7.5YR 5/4) cobbly loam; few fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; about 35 percent cobbles and about 5 percent pebbles; strong effervescence; moderately alkaline.

Solum thickness ranges from 20 to 36 inches. Reaction ranges from neutral to moderately alkaline in the subsoil and is mildly alkaline or moderately alkaline in the substratum.

Ap horizon has value of 2 or 3 and chroma of 2 or 3. Some pedons have an A1 horizon that ranges from 1 to 4 inches thick and has value of 2 or 3 and chroma of 1 or 2. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam, very fine sandy loam, or loam. The IIC horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is cobbly silt loam, cobbly loam, or cobbly sandy loam.

Solona series

The Solona series consists of somewhat poorly drained, moderately permeable soils in depressions and drainageways on ground moraines. These soils formed in loamy glacial till. Slope ranges from 0 to 3 percent.

Solona soils are similar to Shiocton Variant soils and are commonly adjacent to Angelica, Onaway, and Shiocton soils on the landscape. Shiocton Variant soils have cobbly substrata. Angelica soils are in lower positions in the landscape and are poorly drained and very poorly drained. Onaway soils are in higher positions on the landscape and are well drained and moderately well drained. Shiocton soils are similar to the Solona soils in position on the landscape but are formed in stratified silty, loamy, and sandy lacustrine deposits.

Typical pedon of Solona loam, 0 to 3 percent slopes, approximately 660 feet north and 140 feet west of the southeast corner of sec. 11, T. 25 N., R. 17 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many roots; about 3 percent pebbles; neutral; abrupt smooth boundary.

B21t—9 to 19 inches; reddish brown (5YR 4/4) fine sandy loam; common medium prominent yellowish red (5YR 5/8) and few fine prominent strong brown (7.5YR 5/8) and few fine distinct pinkish gray (7.5YR 6/2) mottles; moderate medium and fine subangular blocky structure; friable; common fine roots; thin patchy clay films on faces of peds and in pores and channels; about 3 percent pebbles; moderately alkaline; clear wavy boundary.

B22t—19 to 27 inches; reddish brown (5YR 4/4) fine sandy loam; few fine distinct pinkish gray (7.5YR 6/2) and common medium prominent yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; friable; few roots; thin patchy clay films on faces of peds and in pores and channels; about 8 percent pebbles; moderately alkaline; gradual wavy boundary.

C—27 to 60 inches; reddish brown (5YR 5/4) loam; few fine distinct brown (7.5YR 5/2) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; about 10 percent pebbles; violent effervescence; moderately alkaline.

Thickness of solum and depth to carbonates range from 20 to 32 inches. Reaction is neutral or mildly alkaline in the solum and is mildly alkaline or moderately alkaline in the substratum. Pebble content is less than 15 percent throughout the pedon.

The Ap horizon has value of 2 to 4 and chroma of 1 to 3. Some pedons have an A1 horizon 1 to 5 inches thick with value of 2 or 3 and chroma of 1 or 2. Some pedons have an A2 horizon. The B2t horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is fine sandy loam or loam. Where present, the B3 horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is loam or sandy loam. The C horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is loam or sandy loam.

Tilleda series

The Tilleda series consists of well drained, moderately permeable soils on ground moraines. These soils formed in loamy glacial till. Slope ranges from 1 to 20 percent.

Tilleda soils are similar to Onaway soils and are adjacent to Menominee and Solona soils on the landscape. Onaway soils have thinner sola than Tilleda soils and have free carbonates at a depth of 15 to 30 inches. Menominee soils are similar to the Tilleda soils in position on the landscape but have a 20- to 40-inch-thick sandy mantle. Solona soils are in lower landscape positions in drainageways and depressions and are somewhat poorly drained.

Typical pedon of Tilleda fine sandy loam, 1 to 6 percent slopes, approximately 2,450 feet south and 150 feet west of the center of sec. 7, T. 27 N., R. 15 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; many roots; about 3 percent pebbles; neutral; abrupt smooth boundary.

B2ir—7 to 9 inches; dark brown (7.5YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; common roots; some very dark grayish brown (10YR 3/2) soil in root channels and coating the faces of some peds; about 3 percent pebbles; neutral; abrupt wavy boundary.

A&B—9 to 12 inches; brown (7.5YR 4/2) fine sandy loam (A2), pinkish gray (7.5YR 7/2) dry; moderate thin platy structure; friable; occupies about 70 percent of the horizon as tongues extending into dark reddish brown (5YR 3/3) loam (Bt); moderate medium subangular blocky structure; firm; common roots; thin patchy clay films on faces of peds (Bt); about 3 percent pebbles; neutral; clear wavy boundary.

B&A—12 to 24 inches; dark reddish brown (5YR 3/3) loam (Bt); occupies about 80 percent of the horizon; moderate medium and fine subangular blocky structure; firm; penetrated from above by tongues and interfingers of brown (7.5YR 4/2) fine sandy loam (A2), pinkish gray (7.5YR 7/2) dry; moderate thin platy structure; friable; common roots; thin continuous clay films on faces of peds (Bt); about 3 percent pebbles; slightly acid; clear wavy boundary.

B2t—24 to 30 inches; dark reddish brown (5YR 3/3) loam; moderate medium angular and subangular blocky structure; firm; few roots; thin continuous clay films on faces of peds; about 3 percent pebbles; medium acid; clear wavy boundary.

B3t—30 to 34 inches; dark reddish brown (5YR 3/3) loam; moderate medium subangular blocky structure; friable; few roots; thin discontinuous clay films on faces of peds; about 3 percent pebbles; medium acid; clear wavy boundary.

C—34 to 60 inches; dark reddish brown (5YR 3/3) loam; massive; friable; about 3 percent pebbles; few roots to a depth of about 40 inches; neutral.

Solum thickness ranges from 30 to 60 inches. Depth to free carbonates is more than 60 inches. Reaction ranges from medium acid to neutral in the upper part of the subsoil and is slightly acid to mildly alkaline in the lower part of the subsoil and in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon that ranges from 1 to 4 inches thick and has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is silt loam, loam, or fine sandy loam. Some pedons have an A&B horizon, and some do not have a B&A horizon. The A2 part of the B&A horizon is similar to the A2 horizon. The Bt part of the B&A horizon is similar to the B2t horizon. The B2t horizon, the B3 horizon, and the C horizon all have hue of 2.5YR, 5YR, or 7.5YR; value of 3 to 5, and chroma of 3 to 6. The B2t horizon is loam, clay loam, or sandy clay loam. The B3 horizon is loam or clay loam. The C horizon is gravelly loam, loam, gravelly sandy loam, or sandy loam.

Tilleda Variant

The Tilleda Variant consists of well drained, moderately over rapidly permeable soils on ground moraines. These soils formed mostly in loamy glacial till and are underlain by sandy outwash. Slope ranges from 2 to 12 percent.

Tilleda Variant soils are similar to Rosholt soils and are adjacent to Menominee and Tilleda soils on the landscape. Rosholt soils have less clay and more silt in the upper part of the solum. Menominee and Tilleda soils are similar to the Tilleda Variant soils in position on the landscape. Tilleda soils do not have outwash within a depth of 60 inches. Menominee soils have a 20- to 40-inch-thick sandy mantle.

Typical pedon of Tilleda Variant fine sandy loam, 2 to 6 percent slopes, approximately 950 feet north and 75 feet west of the center of sec. 6, T. 26 N., R. 1 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; many roots; about 5 percent pebbles; slightly acid; abrupt smooth boundary.

A&B—9 to 14 inches; light brownish gray (10YR 6/2) loam (A2), white (10YR 8/1) dry; weak medium platy structure; friable; remnants of reddish brown (5YR 4/4) loam (B2t) occupy about 30 percent of the horizon; moderate medium subangular blocky structure; friable; common roots; thin patchy clay films on faces of peds (B2t); about 5 percent pebbles; acid; slightly gradual wavy boundary.

B&A—14 to 17 inches; reddish brown (5YR 4/4) loam (B2t); moderate medium subangular blocky structure; friable; occupies about 70 percent of the horizon, penetrated by tongues of light brownish gray (10YR 6/2) loam (A2), white (10YR 8/1) dry; weak medium platy structure; friable; common roots; thin patchy clay films on faces of peds (B2t); about 10 percent pebbles; slightly acid; clear wavy boundary.

B2t—17 to 25 inches; reddish brown (5YR 4/4) loam; moderate medium subangular blocky structure; friable; common roots; thin patchy clay films on faces of peds; about 10 percent pebbles; medium acid; clear wavy boundary.

B3t—25 to 36 inches; reddish brown (5YR 5/4) fine sandy loam; moderate medium subangular blocky structure; friable; few roots; thin patchy clay films on faces of a few peds and clay bridging between sand grains; about 5 percent pebbles; medium acid; abrupt wavy boundary.

IIC—36 to 60 inches; light brown (7.5YR 6/4) fine sand; single grain; loose; neutral.

Solum thickness ranges from 20 to 40 inches. Thickness of the loamy mantle ranges from 20 to 40 inches. Reaction ranges from strongly acid to slightly acid in the subsoil and from medium acid to neutral in the substratum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon 1 to 4 inches thick with value of 2 or 3 and chroma 1 or 2. Some pedons have an A2 horizon. Some pedons do not have an A&B horizon. The A2 part of the A&B and B&A horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is loam or fine sandy loam. The B2t part of the A&B and B&A horizons has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, clay loam, or sandy clay loam. The B2t horizon has colors and textures similar to those described for the B2t part of the A&B and B&A horizons. The B3t horizon has colors similar to the B2t horizon. It is loam, sandy loam, fine sandy loam, loamy sand, or loamy fine sand and in some pedons it is the gravelly analogue of these textures. The IIC horizon has hue of 7.5YR or 10YR and value and chroma of 3 to 6. It is fine sand, sand, or stratified sand and gravel.

Wainola series

The Wainola series consists of somewhat poorly drained, rapidly permeable soils on outwash plains and in basins of glacial lakes. These soils formed in sandy outwash deposits. Slope ranges from 0 to 3 percent.

Wainola soils are similar to Au Gres soils and are adjacent to Cormant, Rousseau, and Shawano soils on the landscape. Au Gres soils are less than 50 percent fine sand. Cormant soils are in lower landscape positions and are poorly drained and very poorly drained. Rousseau soils are in slightly higher landscape positions and are moderately well drained. Shawano soils are in higher landscape positions and are excessively drained.

Typical pedon of Wainola fine sand, 0 to 3 percent slopes, approximately 200 feet east and 2,500 feet south of the northwest corner of sec. 4, T. 27 N., R. 17 E.

A1—0 to 2 inches; black (10YR 2/1) fine sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

A2—2 to 5 inches; brown (7.5YR 4/2) fine sand, pinkish gray (7.5YR 6/2) dry; weak thin platy structure; very friable; common roots; strongly acid; abrupt wavy boundary.

B21ir—5 to 9 inches; dark brown (7.5YR 4/4) fine sand; few fine distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; very friable; common roots; medium acid; clear wavy boundary.

B22ir—9 to 22 inches; strong brown (7.5YR 5/6) fine sand; common medium distinct reddish yellow (7.5YR 6/8) and light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; very friable; few roots; medium acid; gradual wavy boundary.

C—22 to 60 inches; brown (7.5YR 5/4) stratified fine sand and very fine sand; common medium prominent reddish yellow (7.5YR 6/8) and common medium faint light yellowish brown (10YR 6/4) single grain; loose; slightly acid.

Solum thickness ranges from 18 to 30 inches. Reaction ranges from strongly acid to slightly acid in the subsoil and is medium acid or slightly acid in the substratum.

The A1 horizon ranges from 1 to 4 inches in thickness. It has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an Ap horizon that has value of 3 or 4 and chroma of 2 or 3. The A2 horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 or 2. It is loamy fine sand or fine sand. The Bir horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 2 to 4. 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 3 or 4.

Wheatley series

The Wheatley series consists of poorly drained and very poorly drained, rapidly permeable soils on outwash plains. These soils formed in sandy deposits underlain by stratified calcareous sand and gravel outwash. Slope ranges from 0 to 2 percent.

Wheatley soils are similar to Au Gres Variant and Cormant soils and are adjacent to them on the landscape. Au Gres Variant soils are in higher landscape positions and are somewhat poorly drained. Cormant soils are similar to the Wheatley soils in position on the landscape but to not have gravel in the substratum.

Typical pedon of Wheatley loamy fine sand, approximately 2,600 feet east and 50 feet south of the center of sec. 36, T. 26 N., R. 16 E.

Ap—0 to 9 inches; black (10YR 2/1) loamy fine sand, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; very friable; many roots; some light brownish gray (2.5Y 6/2) soil in worm channels; neutral; abrupt smooth boundary.

C1—9 to 23 inches; light brownish gray (2.5Y 6/2) fine sand; few fine distinct light olive brown (2.5Y 5/4) mottles; single grain; loose; common roots; neutral; abrupt wavy boundary.

C2—23 to 28 inches; mixed dark grayish brown (10YR 4/2) and brown (10YR 4/3) stratified loamy fine sand and fine sand; few medium prominent yellowish brown (10YR 5/6) mottles; single grain; loose; few roots; about 5 percent pebbles; neutral; clear wavy boundary.

C3g—28 to 60 inches; gray (N 5/0) stratified sand and gravel; single grain; loose; about 25 percent pebbles; strong effervescence; mildly alkaline.

The dark surface layer ranges from 4 to 9 inches thick. Thickness of the sandy mantle over sand and gravel ranges from 20 to 36 inches. Reaction is neutral or mildly alkaline in the upper part of the pedon and mildly alkaline or moderately alkaline in the gravelly lower part.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 0 to 2. In some pedons the upper part of the C horizon is loamy sand.

formation of the soils

This section describes the geology and underlying material in Shawano County. It also describes the factors of soil formation as they relate to the soils in the county and explains the processes of soil formation, or horizon differentiation.

geology and underlying material

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

Shawano County is underlain by igneous and sedimentary rock. The bedrock is overlain by glacial deposits that range from 0 to 300 feet in thickness.

In the western half of the county the glacial deposits are underlain by Precambrian rock. Tigerton anorthosite and the locally named Bowler granite complex (Wolf River granite), along with granite and undifferentiated igneous and metamorphic rocks, are dominant. To the east, generally south of the city of Shawano, there is an area of Upper Cambrian dolomite and sandstone. Continuing east, there is a sequence of Paleozoic rocks: the Ordovician Prairie du Chien dolomite, a narrow band of St. Peter sandstone, and, in the extreme southeastern part of the county, the Galena-Platteville dolomite.

Glacial deposits are glacial till, glacial outwash, and stratified lacustrine deposits. As a result of different advances of the ice sheets and weathering, glacial till differs in color, texture, and depth to free carbonates (*4*). In the western part of the county the till is a brown gravelly loamy sand or sandy loam of Middle Woodfordian, Cary Age. This till has numerous cobbles, stones, and boulders on the surface. The till in the eastern part of the county is mostly reddish brown loam or sandy loam. It is Late Woodfordian or younger in age.

In the western part of the county, glacial outwash occurs on a broad, pitted outwash plain interfingered with a high-lying morainic glacial till. The outwash is mostly stratified sand and gravel. Some areas have many stones on the surface. The outwash deposits in the middle third of the county are quite extensive. They are mostly sand or fine sand and occur along the Wolf River, Red River, Embarrass River and its tributaries, and around Shawano Lake. The outwash deposits in the eastern third of the county are along the Oconto River and Slab City Creek, but are not extensive. These deposits are mostly stratified sand and gravel.

Lacustrine deposits mainly occur in a broad plain adjacent to the Wolf River with scattered lacustrine areas in the eastern part of the county. These deposits range from silt to very fine sand with essentially no gravel. All gradations of texture exist from clayey silty sand to sand.

factors of soil formation

The factors that determine the kind of soil that forms at any given point are 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* the forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. They alter the accumulated material and bring about the development of genetically related horizons. These effects are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil. Usually a long time is required for the development of distinct horizons.

These factors of soil formation are so closely interrelated that few generalizations can be made regarding the effect of any one factor unless conditions are known for the other four.

parent material

Parent material is the unweathered material from which the soil was formed. It largely determines the chemical and mineralogical composition of the soil.

Shawano County is in the glaciated area of northeastern Wisconsin. Most soils formed in glacial till, glacial outwash, or glacial lacustrine deposits. A few formed in organic material.

The glacial till soils formed in unstratified, unsorted glacial debris composed of clay, silt, sand, gravel, stones, and boulders. The different ages of till in Shawano County are distinguished primarily by the depth to carbonates and the textures of the till. Kennan soils formed in loamy drift over loamy sand or sandy loam till (fig. 13). Angelica, Onaway, Solona, and Tilleda soils formed in loam or sandy loam till. Fairport soils formed in loamy till over dolomite bedrock.

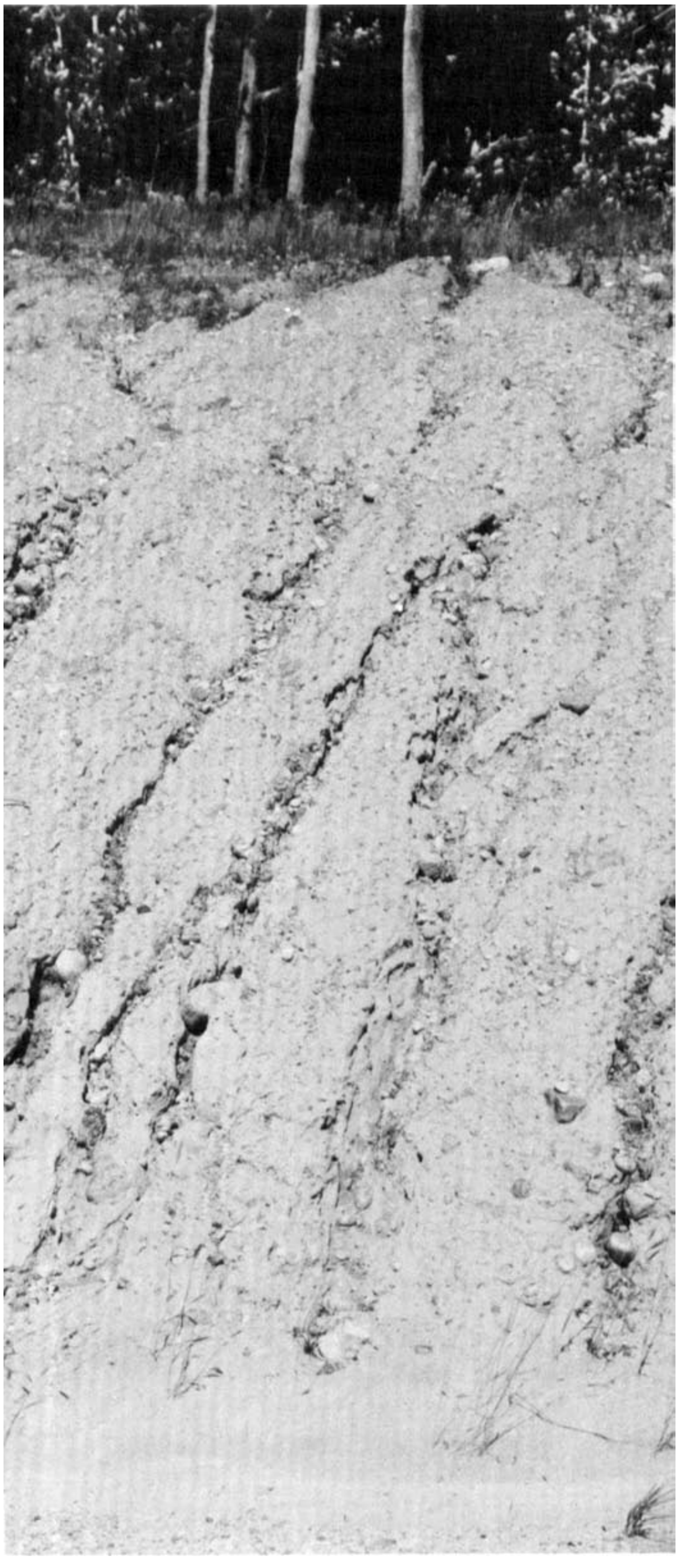

Figure 13.—Fifteen- to twenty-foot deep cut in a drumlin shows the gravelly loamy sand glacial till that underlies most areas of Kennan soils.

Glacial outwash is material deposited by glacial melt water and is characterized by stratified sand and gravel. Some outwash, however, is almost exclusively sandy. Soils that formed in sandy deposits include Croswell, Menahga, Rubicon, and Shawano soils. Antigo, Brill, Elderon, and Rosholt soils formed mostly in loamy drift and are underlain by sand, gravelly sand, or stratified sand and gravel.

Lacustrine deposits in Shawano County are in basins of glacial lakes. These deposits consist mostly of stratified silt, silt loam, very fine sandy loam, loamy very fine sand, very fine sand, or fine sand; some are stratified silty clay and silty clay loam. Briggsville and Manawa soils formed in a thin silty mantle and in silty clay and silty clay loam lacustrine deposits. Alban, Bach, Salter Variant, Plover, and Shiocton soils formed in a loamy mantle over stratified silt, silt loam, very fine sandy loam, loamy very fine sand, very fine sand, and fine sand lacustrine deposits. Brevort, Iosco, and Menominee soils formed in a sandy mantle and in underlying loamy till or lacustrine deposits.

Organic material is the parent material for a number of soils in the county. It consists mainly of sedges, reeds, grasses, and woody fragments in various stages of decomposition. Cathro and Markey soils formed in organic material 16 to 51 inches deep over mineral deposits. Loxley and Seelyeville soils formed in more than 51 inches of organic material. These organic soils are in depressions, basins of past glacial lakes, and drainageways.

climate

Climate affects soil formation through moisture and heat. It has a direct effect on 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. Climate has an indirect effect on soil formation through its influence on plant and animal life.

Differences in climate within the survey area are too small to have had any great effect on the differences between the soils. Shawano County has a humid-temperate continental climate that is favorable to the growth of trees and to the development of soils that have a light-colored surface layer and a subsoil in which clay has accumulated.

plant and animal life

Plants and animals have an important role in soil formation. Several processes occur simultaneously, including the capture of energy through photosynthesis, decomposition of plant residues, cation exchange, and the formation of organic and mineral compounds.

Most soils of Shawano County formed under forest vegetation. This results in a light-colored soil relatively low in organic matter. Also, because tree roots intercept water at greater depths than grasses, there is more effective leaching. This removes nutrients and allows for clay accumulation at greater depths. In addition, there is an abundance of microflora, such as bacteria and fungi, which have important roles in decomposing organic matter and recycling the nutrients.

Animals in the soil, including earthworms, insects, and rodents, mix the soil and contribute additional organic matter affecting soil structure, porosity, and nutrient content. Human civilization also has an important effect on soil formation by disturbing natural soil processes. Many soils have been altered by draining, clearing, burning, and cultivating. Repeatedly removing plant cover has accelerated erosion. Overcultivation has often contributed to the loss of organic matter and has reduced the infiltration rate. In some areas overcultivation and the use of heavy equipment has changed the loose, porous surface layer to clods.

relief

Relief influences soil formation in Shawano County by affecting the amount of precipitation absorbed in the soil; by influencing the erosion rate; and by directing the movement of materials in suspension or solution from one area to another. Generally, the steeper soils have thinner solums and less well developed profiles than gently sloping soils, which have more water percolating through the profile.

Relief directly affects external and internal drainage in the soils. In Shawano County, Onaway, Solona, and Angelica soils form a drainage sequence. The well drained and moderately well drained Onaway soils are on higher lying ridges and are gently sloping to steep. The somewhat poorly drained Solona soils are in lower areas and are nearly level and gently sloping. The poorly drained and very poorly drained Angelica soils are in low-lying flats, depressions, and drainageways and are nearly level.

time

Time has had some effect on differences between the soils of the county. Soils of the alluvial plains, for example, do not have distinct horizons because the soil material has not been in place long enough for the soil-forming processes to take full effect. Well drained soils that formed in glacial till, on the other hand, have well-defined horizons as the result of processes that have been active for thousands of years.

horizon differentiation

A combination of basic processes is responsible for horizon differentiation. There are four main processes: gains, losses, transfers, and transformations. These generally do not act alone, and all soils have at least the potential for all of them. Some changes promote horizon differentiation, and others retard or offset horizon differentiation. The nature of the soil at any given point is the net result of all changes.

An example of how these soil-forming processes interact can be seen in the Onaway soils. Onaway soils are well drained or moderately well drained because they are high in the landscape and are underlain by relatively porous till. The parent material was calcareous loam and sandy loam glacial till that was about 5 to 10 percent by volume pebbles, mostly dolomite. The climate was favorable for the growth of plants. Plants and animals contributed to the accumulation of organic matter and organic acids, and they mixed the soil to some extent. These processes accelerated as more and higher forms of organisms grew in the soil and produced more organic residue and acids.

Free lime in the soil material was gradually dissolved and moved downward by percolating water into the substratum. Suspended particles of clay also were translocated downward in the soil by percolating water. As a result, the developed portion of the soil has no free carbonates and there is more clay in the middle and lower parts of the subsoil than in other parts of the soil.

While free carbonates and clay were being moved downward in the soil, organic matter in various stages of decompositon was accumulating on or near the surface. Decomposed organic matter gave the surface layer a darker color than it originally had.

Chemical weathering of the dolomite and other weatherable minerals along with the accumulation of clay gradually changed the middle part of the soil material to clay loam and loam with about 5 percent pebbles by volume. Oxidized iron, which occurs as impurities in the dolomite, gives this layer a redder color than the underlying unweathered till.

As a result of these processes, the Onaway soils now have a surface layer of fine sandy loam; a subsurface layer mostly of fine sandy loam; and a subsoil that is clay loam in the upper part and loam in the lower part. These soils are underlain by unweathered, calcareous sandy loam glacial till at a depth of about 28 inches. This underlying till has changed little since it was deposited.

Processes that took place in the formation of Onaway soils were: *gains* of organic matter in the surface layer; *loss* of clay from the upper part of the soil and subsequent *transfer* to the middle and lower parts of the subsoil; and *transformation* of iron compounds in the subsoil.

All these processes are active in the soils of Shawano County. The kinds of parent material in Shawano County together with the relief have, to a great extent, determined the kinds of processes that are dominant in the formation of all the soils. These processes are, in turn, largely responsible for the differences and similarities between 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.

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

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

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.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

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.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

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.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

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 does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

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.

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 melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

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. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

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, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A 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) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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. In sprinkler irrigation, water is sprayed over the soil surface through pipes or nozzles from a pressure system.

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 (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark, 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. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition. The content of organic matter in the plow layer of the soils in Shawano County 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, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

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.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

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.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

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 underlying material. 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.

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 (or rise) of 20 feet in 100 feet of horizontal distance. The soils of Shawano County are described in terms that indicate their range in slope gradient: 0 to 2 percent, nearly level (0 to 3 percent, nearly level and gently sloping for somewhat poorly drained soils); 2 to 6 percent, gently sloping (1 to 6 percent, nearly level and gently sloping for some soils); 6 to 12 percent, sloping; 12 to 20 percent, moderately steep (12 to 30 percent, moderately steep and steep for some sandy soils); and 20 to 30 percent, steep.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 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 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millime-ters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

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 grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

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.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

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."

Tiers. Layers used to define the control section in the classification of organic soils. The organic material is divided somewhat arbitrarily into three tiers. The surface tier is the upper 12 inches, the subsurface tier is the next 24 inches, and the bottom tier is the lower 16 inches.

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.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Based on records kept at Shawano, Wisconsin, during the period 1930-1959]

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Precipitation: Average	Precipitation: 1 year in 10 will have-- Less than--	Precipitation: 1 year in 10 will have-- More than--	Precipitation: Days with 0.1 inch or more precipitation	Precipitation: Average precipitation in the form of snow and sleet
	°F	°F	°F	°F	In	In	In		In
January---	26.6	7.2	21.6	12.0	1.52	0.64	2.79	5	12.2
February--	29.6	8.6	22.1	16.5	1.35	0.52	2.78	4	9.9
March-----	39.3	19.4	31.7	25.9	1.72	0.58	3.41	4	8.7
April-----	56.4	32.7	46.8	41.6	2.60	1.38	4.79	5	2.0
May-------	70.2	43.6	61.1	53.6	3.33	1.45	5.96	6	0.4
June------	79.7	54.0	68.9	63.9	3.93	1.93	6.36	7	0.0
July------	84.6	58.4	73.6	69.3	2.91	1.19	5.01	6	0.0
August----	81.9	56.2	71.0	66.4	3.64	1.35	6.15	6	0.0
September-	72.7	48.1	62.6	58.9	3.11	1.31	5.99	6	*
October---	60.3	37.8	53.2	45.4	2.20	0.30	4.79	4	0.4
November--	42.5	25.5	37.6	30.4	2.28	0.79	4.54	5	4.3
December--	29.9	13.6	25.6	17.9	1.51	0.28	2.48	4	9.0

* Trace.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Based on records kept at Shawano, Wisconsin, during the period 1930-1959]

Probability	Temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Last in spring:					
2 years in 10 later than--	Apr. 10	Apr. 18	Apr. 30	May 16	May 28
4 years in 10 later than--	Apr. 3	Apr. 11	Apr. 22	May 9	May 21
6 years in 10 later than--	Mar. 27	Apr. 4	Apr. 16	May 3	May 15
8 years in 10 later than--	Mar. 20	Mar. 27	Apr. 9	Apr. 26	May 8
First in fall:					
2 years in 10 earlier than	Nov. 5	Oct. 22	Oct. 9	Sept. 27	Sept. 16
4 years in 10 earlier than	Nov. 13	Oct. 29	Oct. 17	Oct. 5	Sept. 23
6 years in 10 earlier than	Nov. 19	Nov. 5	Oct. 24	Oct. 11	Sept. 29
8 years in 10 earlier than	Nov. 27	Nov. 12	Oct. 31	Oct. 19	Oct. 6

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AfB	Alban fine sandy loam, 2 to 6 percent slopes	935	0.2
AgB	Alban Variant loamy sand, 2 to 6 percent slopes	1,305	0.2
Ah	Angelica silt loam	5,615	0.9
AtB	Antigo silt loam, 1 to 6 percent slopes	1,300	0.2
AuA	Au Gres loamy sand, 0 to 3 percent slopes	6,745	1.1
AxA	Au Gres Variant loamy fine sand, 0 to 3 percent slopes	1,525	0.3
Ba	Bach silt loam	5,100	0.9
BrB	Boyer sandy loam, 1 to 6 percent slopes	810	0.1
Bs	Brevort mucky loamy sand	3,085	0.5
BtA	Briggsville silt loam, 0 to 2 percent slopes	475	0.1
BtB	Briggsville silt loam, 2 to 6 percent slopes	510	0.1
BuA	Brill silt loam, 0 to 3 percent slopes	2,490	0.4
Co	Cormant mucky loamy fine sand	15,175	2.5
CrB	Cromwell sandy loam, 1 to 6 percent slopes	6,970	1.2
CrC	Cromwell sandy loam, 6 to 12 percent slopes	3,480	0.6
CrD	Cromwell sandy loam, 12 to 20 percent slopes	2,145	0.4
CtA	Croswell loamy sand, 0 to 3 percent slopes	8,085	1.4
Dp	Dumps	115	*
EcD	Elderon-Rosholt complex, 12 to 20 percent slopes	2,600	0.4
EcE	Elderon-Rosholt complex, 20 to 35 percent slopes	2,330	0.4
FpB	Fairport fine sandy loam, 1 to 6 percent slopes	1,730	0.3
FpC	Fairport fine sandy loam, 6 to 15 percent slopes	750	0.1
Fu	Fordum loam	10,800	1.8
Fx	Fluvents, loamy	720	0.1
IsA	Iosco loamy sand, 0 to 3 percent slopes	8,065	1.4
KaB	Kennan bouldery fine sandy loam, 1 to 6 percent slopes	26,195	4.4
KaC	Kennan bouldery fine sandy loam, 6 to 12 percent slopes	19,565	3.3
KaD	Kennan bouldery fine sandy loam, 12 to 20 percent slopes	9,500	1.6
KaE	Kennan bouldery fine sandy loam, 20 to 30 percent slopes	2,015	0.3
LvB	Lorenzo Variant sandy loam, 1 to 6 percent slopes	785	0.1
LvC	Lorenzo Variant sandy loam, 6 to 15 percent slopes	355	0.1
Lx	Loxley mucky peat	4,630	0.8
MaA	Mahtomedi-Menahga loamy sands, 0 to 2 percent slopes	980	0.2
MaB	Mahtomedi-Menahga loamy sands, 2 to 6 percent slopes	4,160	0.7
MaC	Mahtomedi-Menahga loamy sands, 6 to 12 percent slopes	1,930	0.3
MaD	Mahtomedi-Menahga loamy sands, 12 to 30 percent slopes	3,230	0.5
McA	Manawa silt loam, 0 to 3 percent slopes	430	0.1
Mk	Markey and Cathro mucks	46,820	7.7
MnA	Menahga loamy sand, 0 to 2 percent slopes	2,080	0.3
MnB	Menahga loamy sand, 2 to 6 percent slopes	12,650	2.1
MnC	Menahga loamy sand, 6 to 12 percent slopes	3,790	0.6
MnD	Menahga loamy sand, 12 to 30 percent slopes	1,970	0.3
MsB	Menominee loamy sand, 1 to 6 percent slopes	11,410	1.9
MsC	Menominee loamy sand, 6 to 12 percent slopes	2,755	0.5
MsD	Menominee loamy sand, 12 to 20 percent slopes	920	0.2
Mu	Minocqua silt loam	16,700	2.8
ObA	Oesterle loam, 0 to 3 percent slopes	17,275	2.9
OeB	Onaway fine sandy loam, 2 to 6 percent slopes	39,325	6.6
OeC2	Onaway fine sandy loam, 6 to 12 percent slopes, eroded	9,680	1.6
OeD2	Onaway fine sandy loam, 12 to 20 percent slopes, eroded	1,580	0.3
OeE	Onaway fine sandy loam, 20 to 35 percent slopes	510	0.1
OfB	Onaway fine sandy loam, cobbly substratum, 1 to 6 percent slopes	1,835	0.3
OfC2	Onaway fine sandy loam, cobbly substratum, 6 to 12 percent slopes, eroded	295	*
Pt	Pits	980	0.2
PvA	Plover loam, 0 to 3 percent slopes	795	0.1
RmD	Rock outcrop-Rosholt Variant complex, 2 to 35 percent slopes	735	0.1
RoA	Rosholt fine sandy loam, 0 to 2 percent slopes	1,565	0.3
RoB	Rosholt fine sandy loam, 2 to 6 percent slopes	44,270	7.3
RoC	Rosholt fine sandy loam, 6 to 12 percent slopes	12,035	2.0
RoD	Rosholt fine sandy loam, 12 to 20 percent slopes	3,000	0.5
RpB	Rosholt-Elderon complex, 2 to 6 percent slopes	620	0.1
RpC	Rosholt-Elderon complex, 6 to 12 percent slopes	895	0.1
RrD	Rosholt-Rock outcrop complex, 2 to 35 percent slopes	2,240	0.4
RsA	Rousseau loamy fine sand, 0 to 2 percent slopes	4,175	0.7
RsB	Rousseau loamy fine sand, 2 to 6 percent slopes	6,980	1.2
RuB	Rubicon sand, 1 to 6 percent slopes	2,170	0.4
RuC	Rubicon sand, 6 to 12 percent slopes	810	0.1
RuD	Rubicon sand, 12 to 20 percent slopes	365	0.1
SaA	Salter Variant very fine sandy loam, 0 to 2 percent slopes	750	0.1
SaB	Salter Variant very fine sandy loam, 2 to 6 percent slopes	1,110	0.2

See footnote at end of table.

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
SaC	Salter Variant very fine sandy loam, 6 to 12 percent slopes	320	0.1
Sb	Saprists, ponded	1,200	0.2
ScA	Scott Lake loam, 0 to 3 percent slopes	8,385	1.4
Sd	Seelyeville muck	32,870	5.5
SfB	Shawano loamy fine sand, 1 to 6 percent slopes	7,495	1.3
SfC	Shawano loamy fine sand, 6 to 12 percent slopes	4,495	0.8
SfD	Shawano loamy fine sand, 12 to 20 percent slopes	855	0.1
SgB	Shawano-Briggsville complex, 2 to 6 percent slopes	265	*
SgC	Shawano-Briggsville complex, 6 to 12 percent slopes	350	0.1
ShA	Shiocton silt loam, 0 to 3 percent slopes	9,350	1.6
SkA	Shiocton Variant silt loam, 0 to 3 percent slopes	445	0.1
SoA	Solona loam, 0 to 3 percent slopes	36,250	6.1
SyB	Solona-Onaway complex, 1 to 6 percent slopes	9,950	1.7
TlB	Tilleda fine sandy loam, 1 to 6 percent slopes	31,130	5.2
TlC2	Tilleda fine sandy loam, 6 to 12 percent slopes, eroded	8,120	1.4
TlD	Tilleda fine sandy loam, 12 to 20 percent slopes	1,890	0.3
TvB	Tilleda Variant fine sandy loam, 2 to 6 percent slopes	2,020	0.3
TvC2	Tilleda Variant fine sandy loam, 6 to 12 percent slopes, eroded	695	0.1
WaA	Wainola fine sand, 0 to 3 percent slopes	9,280	1.6
Wh	Wheatley loamy fine sand	1,710	0.3
	Water areas < 40 acres in size	1,360	0.2
	Water areas > 40 acres in size	8,895	1.5
	Total	597,055	100.0

* Less than 0.1 percent.

TABLE 4.--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	Acres
AfB	Alban fine sandy loam, 2 to 6 percent slopes	935
Ah	Angelica silt loam (where drained)	5,615
AtB	Antigo silt loam, 1 to 6 percent slopes	1,300
Ba	Bach silt loam (where drained)	5,100
BtA	Briggsville silt loam, 0 to 2 percent slopes	475
BtB	Briggsville silt loam, 2 to 6 percent slopes	510
BuA	Brill silt loam, 0 to 3 percent slopes	2,490
FpB	Fairport fine sandy loam, 1 to 6 percent slopes	1,730
KaB	Kennan bouldery fine sandy loam, 1 to 6 percent slopes (where rock fragments are removed)	26,195
McA	Manawa silt loam, 0 to 3 percent slopes (where drained)	430
ObA	Oesterle loam, 0 to 3 percent slopes (where drained)	17,275
OeB	Onaway fine sandy loam, 2 to 6 percent slopes	39,325
OfB	Onaway fine sandy loam, cobbly substratum, 1 to 6 percent slopes	1,835
PvA	Plover loam, 0 to 3 percent slopes (where drained)	795
SaA	Salter Variant very fine sandy loam, 0 to 2 percent slopes	750
SaB	Salter Variant very fine sandy loam, 2 to 6 percent slopes	1,110
ScA	Scott Lake loam, 0 to 3 percent slopes	8,385
ShA	Shiocton silt loam, 0 to 3 percent slopes (where drained)	9,350
SkA	Shiocton Variant silt loam, 0 to 3 percent slopes (where drained)	445
SoA	Solona loam, 0 to 3 percent slopes (where drained)	36,250
SyB	Solona-Onaway complex, 1 to 6 percent slopes	9,950
TlB	Tilleda fine sandy loam, 1 to 6 percent slopes	31,130
TvB	Tilleda Variant fine sandy loam, 2 to 6 percent slopes	2,020
	Total	203,400

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Corn silage	Oats	Grase-legume hay*	Kentucky bluegrass
	Bu	Ton	Bu	Ton	AUM
AfB------------------------ Alban	85	13	70	3.5	2.1
AgB------------------------ Alban Variant	75	12	65	4.0	2.1
Ah------------------------- Angelica	85	13	70	4.5	3.7
AtB------------------------ Antigo	90	14	80	4.0	3.2
AuA------------------------ Au Gres	50	8	55	3.0	1.5
AxA------------------------ Au Gres Variant	70	11	60	3.0	3.5
Ba------------------------- Bach	105	18	80	4.5	4.0
BrB------------------------ Boyer	80	13	60	3.4	1.8
Bs------------------------- Brevort	75	13	50	---	2.5
BtA------------------------ Briggsville	100	16	75	4.5	4.3
BtB------------------------ Briggsville	100	16	75	4.5	4.1
BuA------------------------ Brill	90	14	80	4.5	3.8
Co------------------------- Cormant	60	10	55	3.0	3.0
CrB, CrC------------------- Cromwell	65	11	60	3.5	1.5
CrD------------------------ Cromwell	---	---	---	3.0	1.2
CtA------------------------ Croswell	45	7	40	2.5	1.1
Dp**. Dumps					
EcD------------------------ Elderon-Rosholt	---	---	---	3.4	1.6
EcE------------------------ Elderon-Rosholt	---	---	---	---	1.3
FpB------------------------ Fairport	85	14	70	4.0	3.0
FpC------------------------ Fairport	80	13	60	3.0	2.5

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Grass-legume hay*	Kentucky bluegrass
	Bu	Ton	Bu	Ton	AUM
Fu----- Fordum	---	---	---	---	3.0
Fx. Fluvents					
IsA----- Iosco	65	11	65	4.0	3.0
KaB----- Kennan	80	13	75	4.5	2.5
KaC, KaD----- Kennan	75	12	70	4.5	2.0
KaE----- Kennan	---	---	---	---	1.3
LvB----- Lorenzo Variant	70	11	55	3.5	2.1
LvC----- Lorenzo Variant	65	9	50	3.2	2.0
Lx----- Loxley	---	---	---	---	---
MaA, MaB, MaC----- Mahtomedi-Menahga	45	7	33	2.2	1.2
MaD----- Mahtomedi-Menahga	---	---	---	1.5	0.9
McA----- Manawa	100	16	75	4.5	4.3
Mk----- Markey and Cathro	90	15	70	---	3.0
MnA, MnB, MnC----- Menahga	45	8	40	2.5	1.2
MnD----- Menahga	---	---	---	1.5	0.7
MsB----- Menominee	70	11	65	3.5	3.0
MsC----- Menominee	60	10	55	3.0	2.7
MsD----- Menominee	55	9	50	2.5	2.3
Mu----- Minocqua	75	12	65	---	3.0
ObA----- Oesterle	75	12	70	4.0	3.5
OeB----- Onaway	100	16	75	4.5	4.0
OeC2----- Onaway	90	15	70	4.0	3.8
OeD2----- Onaway	70	12	55	3.5	3.5

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Grass-legume hay*	Kentucky bluegrass
	Bu	Ton	Bu	Ton	AUM
OeE----------------------- Onaway	---	---	---	3.0	3.0
OfB----------------------- Onaway	90	15	75	4.5	4.0
OfC2---------------------- Onaway	80	14	65	4.0	3.5
Pt**. Pits					
PvA----------------------- Plover	80	12	70	3.5	2.1
RmD**--------------------- Rock outcrop-Rosholt Variant	---	---	---	---	---
RoA----------------------- Rosholt	75	12	70	4.0	2.7
RoB----------------------- Rosholt	75	12	70	4.0	2.5
RoC----------------------- Rosholt	65	11	50	3.3	2.0
RoD----------------------- Rosholt	55	9	45	3.3	1.6
RpB----------------------- Rosholt-Elderon	76	12	70	4.0	2.5
RpC----------------------- Rosholt-Elderon	69	11	56	3.6	2.0
RrD----------------------- Rosholt-Rock outcrop	---	---	---	---	---
RsA, RsB------------------ Rousseau	60	10	60	2.5	2.1
RuB----------------------- Rubicon	45	7	45	2.5	1.1
RuC----------------------- Rubicon	---	---	---	2.0	1.5
RuD----------------------- Rubicon	---	---	---	1.5	0.9
SaA----------------------- Salter Variant	100	16	80	4.5	4.0
SaB----------------------- Salter Variant	100	16	80	4.5	4.0
SaC----------------------- Salter Variant	90	16	70	4.0	3.5
Sb**. Saprists					
ScA----------------------- Scott Lake	80	12	75	4.0	3.8
Sd------------------------ Seelyeville	100	15	65	---	3.3

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Grass-legume hay*	Kentucky bluegrass
	Bu	Ton	Bu	Ton	AUM
SfB----------------------- Shawano	55	9	55	3.0	1.5
SfC----------------------- Shawano	45	7	45	2.5	1.3
SfD----------------------- Shawano	---	---	---	2.0	1.0
SgB----------------------- Shawano-Briggsville	58	9	52	3.1	3.0
SgC----------------------- Shawano-Briggsville	50	8	39	2.2	2.7
ShA----------------------- Shiocton	85	13	75	4.5	4.0
SkA----------------------- Shiocton Variant	95	16	75	4.5	4.0
SoA----------------------- Solona	100	16	75	4.5	4.0
SyB----------------------- Solona-Onaway	100	16	75	4.5	4.0
TlB----------------------- Tilleda	100	15	75	5.0	4.0
TlC2---------------------- Tilleda	90	14	70	5.0	3.5
TlD----------------------- Tilleda	80	12	65	4.5	3.0
TvB, TvC2----------------- Tilleda Variant	85	13	70	4.0	3.5
WaA----------------------- Wainola	65	11	60	3.5	2.1
Wh------------------------ Wheatley	60	10	55	3.0	3.0

* Grass-legume hay yields are for bromegrass-alfalfa mixture.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	750	---	---	---	---
II	295,925	150,980	132,030	12,915	---
III	82,420	72,825	8,785	810	---
IV	93,995	22,560	17,550	53,885	---
V	10,800	---	10,800	---	---
VI	90,120	9,420	74,170	6,530	---
VII	10,495	---	---	10,495	---
VIII	1,200	---	---	1,200	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
AfB----------------- Alban	2o	Slight	Slight	Slight	Slight	Sugar maple----------	60	Red pine, eastern white pine, white spruce.
						American basswood---	---	
						Yellow birch--------	---	
AgB----------------- Alban Variant	2o	Slight	Slight	Slight	Slight	Sugar maple----------	60	Eastern white pine, red pine, white spruce.
						Red pine------------	---	
						Northern red oak----	---	
						Paper birch---------	---	
						American basswood---	---	
Ah------------------ Angelica	3w	Slight	Severe	Severe	Severe	Balsam fir----------	54	White spruce, black spruce, northern white-cedar.
						Quaking aspen-------	60	
						Sugar maple---------	---	
						Yellow birch--------	---	
						Northern white-cedar	---	
						Black ash-----------	---	
AtB----------------- Antigo	1o	Slight	Slight	Slight	Slight	Sugar maple---------	66	Eastern white pine, red pine, white spruce.
						American basswood---	69	
						Northern red oak----	---	
						Eastern white pine--	---	
						Yellow birch--------	71	
						White ash-----------	74	
						Bigtooth aspen------	---	
AuA----------------- Au Gres	3s	Slight	Slight	Severe	Slight	Red pine------------	56	White spruce, black spruce, eastern white pine, northern white-cedar.
						Quaking aspen-------	60	
						Balsam fir----------	---	
						Paper birch---------	---	
						Red maple-----------	---	
						Eastern white pine--	---	
						Northern pin oak----	---	
AxA----------------- Au Gres Variant	3s	Slight	Slight	Moderate	Slight	Red pine------------	56	Red pine, eastern white pine, white spruce.
						Eastern white pine--	---	
						Paper birch---------	---	
						Balsam fir----------	---	
						Northern pin oak----	---	
Ba------------------ Bach	3w	Slight	Severe	Severe	Severe	Red maple-----------	60	Northern white-cedar, eastern white pine, red maple, white spruce.
						Bur oak-------------	66	
						White ash-----------	66	
						Black ash-----------	---	
						Swamp white oak-----	66	
						Silver maple--------	91	
BrB----------------- Boyer	3o	Slight	Slight	Slight	Slight	Northern red oak----	59	Eastern white pine, red pine, white spruce.
						White oak-----------	---	
						Black oak-----------	---	
						Quaking aspen-------	---	
Bs------------------ Brevort	4w	Slight	Severe	Severe	Severe	Northern white-cedar	29	
						Quaking aspen-------	---	
						Balsam fir----------	---	
						Red maple-----------	---	
						Silver maple--------	---	
						White ash-----------	---	
BtA, BtB------------ Briggsville	2o	Slight	Slight	Slight	Slight	Northern red oak----	65	Eastern white pine, white spruce, red pine.
						Sugar maple---------	---	
						White ash-----------	---	
						American basswood---	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Common trees	Site index	
BuA------------------ Brill	2o	Slight	Slight	Slight	Slight	Sugar maple----------	62	White spruce, eastern white pine, red pine.
						Yellow birch---------	71	
						American basswood---	69	
						White ash-----------	74	
						Northern red oak----	---	
						Eastern white pine--	---	
						Bigtooth aspen------	---	
Co------------------- Cormant	3w	Slight	Moderate	Moderate	Moderate	Quaking aspen-------	60	Eastern white pine, white spruce.
						Black ash-----------	---	
						Balsam fir----------	---	
CrB, CrC------------ Cromwell	2o	Slight	Slight	Slight	Slight	Red pine------------	58	Red pine, jack pine.
						Eastern white pine--	53	
						Sugar maple---------	---	
						Yellow birch--------	---	
CrD------------------ Cromwell	2r	Moderate	Moderate	Slight	Slight	Red pine------------	58	Red pine, jack pine.
						Eastern white pine--	53	
						Sugar maple---------	---	
						Yellow birch--------	---	
CtA------------------ Croswell	2s	Slight	Slight	Severe	Slight	Red pine------------	63	Red pine, eastern white pine, jack pine, red maple.
						Quaking aspen-------	---	
						Jack pine-----------	69	
						Northern red oak----	65	
						Eastern white pine--	---	
						Bigtooth aspen------	---	
						Red maple-----------	---	
EcD*, EcE*:								
Elderon------------	3r	Moderate	Moderate	Slight	Slight	Sugar maple---------	57	Red pine, eastern white pine.
						Yellow birch--------	---	
						American basswood---	---	
						Red maple-----------	---	
						Northern red oak----	---	
Rosholt------------	2r	Moderate	Moderate	Slight	Slight	Sugar maple---------	64	Red pine, eastern white pine.
						American basswood---	---	
						Yellow birch--------	---	
						Northern red oak----	---	
FpB, FpC------------ Fairport	2o	Slight	Slight	Slight	Slight	Sugar maple---------	64	White spruce, eastern white pine, red pine.
						Northern red oak----	---	
						American basswood---	---	
						White ash-----------	---	
Fu------------------- Fordum	3w	Slight	Severe	Severe	Moderate	Silver maple--------	80	Silver maple, red maple.
						Red maple-----------	---	
IsA------------------ Iosco	2o	Slight	Slight	Severe	Slight	Quaking aspen-------	60	White spruce, eastern white pine, northern white-cedar.
						White ash-----------	55	
						Red maple-----------	53	
						Yellow birch--------	53	
						Northern pin oak----	56	
						Eastern white pine--	53	
						Sugar maple---------	53	
KaB, KaC------------ Kennan	1o	Slight	Slight	Slight	Slight	Northern red oak----	76	Red pine, eastern white pine, white spruce.
						Sugar maple---------	69	
						American basswood---	69	
						White ash-----------	---	
KaD, KaE------------ Kennan	1r	Moderate	Moderate	Slight	Slight	Northern red oak----	76	Red pine, eastern white pine, white spruce.
						Sugar maple---------	69	
						American basswood---	69	
						White ash-----------	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
LvB, LvC----------- Lorenzo Variant	3o	Slight	Slight	Slight	Slight	Sugar maple--------- American basswood--- Quaking aspen------- Bigtooth aspen------ Northern pin oak---- Jack pine----------- Eastern white pine-- Red pine------------	51 --- --- --- --- --- --- ---	Eastern white pine, red pine, jack pine.
MaA*, MaB*, MaC*: Mahtomedi----------	3s	Slight	Slight	Severe	Slight	Red pine------------ Jack pine----------- Eastern white pine--	55 60 55	Red pine, jack pine.
Menahga-----------	3s	Slight	Slight	Moderate	Slight	Red pine------------ Eastern white pine-- Jack pine----------- Northern pin oak----	56 54 60 55	Red pine, eastern white pine.
MaD*: Mahtomedi---------	3s	Moderate	Moderate	Severe	Slight	Red pine------------ Jack pine----------- Eastern white pine--	55 60 55	Red pine, jack pine.
Menahga-----------	3s	Moderate	Severe	Moderate	Slight	Red pine------------ Eastern white pine-- Jack pine----------- Northern pin oak----	56 54 60 55	Red pine, eastern white pine.
McA---------------- Manawa	2c	Slight	Slight	Moderate	Moderate	Sugar maple--------- Northern red oak---- White ash----------- Red maple----------- American basswood---	58 59 71 --- 67	Red maple, green ash, white ash, white spruce, eastern white pine.
Mk*: Markey------------	2w	Slight	Severe	Severe	Severe	Northern white-cedar Balsam fir---------- Black spruce-------- Tamarack------------ Black ash----------- Quaking aspen------- White spruce--------	41 50 --- --- --- --- ---	
Cathro------------	3w	Slight	Severe	Severe	Severe	Balsam fir---------- Northern white-cedar Tamarack------------ Red maple----------- White spruce--------	40 33 48 --- ---	
MnA, MnB, MnC------ Menahga	3s	Slight	Slight	Moderate	Slight	Red pine------------ Eastern white pine-- Jack pine----------- Northern pin oak----	56 54 60 55	Red pine, eastern white pine.
MnD---------------- Menahga	3s	Moderate	Severe	Moderate	Slight	Red pine------------ Eastern white pine-- Jack pine----------- White spruce--------	56 54 60 59	Red pine, eastern white pine.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
MsB, MsC, MsD------ Menominee	1s	Slight	Slight	Moderate	Slight	Northern red oak----	71	Red pine, eastern white pine, white spruce.
						Sugar maple---------	64	
						American basswood---	---	
						Red maple-----------	---	
Mu----------------- Minocqua	3w	Slight	Severe	Moderate	Moderate	Red maple-----------	55	Red maple, white ash, white spruce, black spruce.
						White ash-----------	---	
						American elm--------	---	
						Black ash-----------	---	
						American basswood---	---	
ObA---------------- Oesterle	3o	Slight	Slight	Slight	Slight	White ash-----------	55	Red maple, white ash, white spruce.
						Green ash-----------	---	
						Red maple-----------	---	
						Silver maple--------	---	
						American elm--------	---	
OeB, OeC2---------- Onaway	2o	Slight	Slight	Slight	Slight	Sugar maple---------	61	White spruce, eastern white pine, red pine.
						Yellow birch--------	---	
						Northern red oak----	69	
						American basswood---	---	
						White ash-----------	---	
						Eastern white pine--	---	
OeD2, OcE---------- Onaway	2r	Moderate	Moderate	Slight	Slight	Sugar maple---------	61	White spruce, eastern white pine, red pine.
						Yellow birch--------	---	
						Northern red oak----	69	
						American basswood---	---	
						White ash-----------	---	
						Eastern white pine--	---	
OfB, OfC2---------- Onaway	2o	Slight	Slight	Slight	Slight	Sugar maple---------	62	Red pine, eastern white pine, white spruce.
						White ash-----------	---	
						Northern red oak----	69	
						American basswood---	---	
						Yellow birch--------	---	
						Eastern white pine--	---	
PvA---------------- Plover	2o	Slight	Slight	Slight	Slight	Red maple-----------	65	Eastern white pine, white spruce, black spruce.
						American basswood---	---	
						American elm--------	---	
						Yellow birch--------	---	
RmD*: Rock outcrop.								
Rosholt Variant---	2d	Moderate	Moderate	Moderate	Slight	Sugar maple---------	58	Red pine, eastern white pine, white spruce.
						Red maple-----------	---	
						Yellow birch--------	---	
						Paper birch---------	---	
						Quaking aspen-------	---	
						Eastern hemlock-----	---	
						American basswood---	---	
RoA, RoB, RoC------ Rosholt	2o	Slight	Slight	Slight	Slight	Sugar maple---------	64	Red pine, eastern white pine.
						American basswood---	---	
						Yellow birch--------	---	
						Northern red oak----	---	
RoD---------------- Rosholt	2r	Moderate	Moderate	Slight	Slight	Sugar maple---------	64	Red pine, eastern white pine.
						American basswood---	---	
						Yellow birch--------	---	
						Northern red oak----	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
RpB*, RpC*:								
Rosholt	2o	Slight	Slight	Slight	Slight	Sugar maple	64	Red pine, eastern white pine.
						American basswood	---	
						Yellow birch	---	
						Northern red oak	---	
Elderon	3o	Slight	Slight	Slight	Slight	Sugar maple	57	Red pine, eastern white pine.
						Yellow birch	---	
						American basswood	---	
						Red maple	---	
						Northern red oak	---	
RrD*:								
Rosholt	2r	Moderate	Moderate	Slight	Slight	Sugar maple	64	Red pine, eastern white pine.
						American basswood	---	
						Yellow birch	---	
						Northern red oak	---	
Rock outcrop.								
RsA, RsB Rousseau	1s	Slight	Slight	Severe	Slight	Northern red oak	71	Red pine, jack pine, white spruce.
						Red maple	---	
						Balsam fir	---	
						Eastern white pine	65	
						Red pine	65	
						Black oak	66	
RuB, RuC Rubicon	3s	Slight	Slight	Moderate	Slight	Red pine	57	Red pine, eastern white pine, jack pine.
						Jack pine	60	
						Northern pin oak	---	
						Eastern white pine	57	
RuD Rubicon	3s	Moderate	Moderate	Moderate	Slight	Red pine	57	Red pine, eastern white pine, jack pine.
						Jack pine	60	
						Northern pin oak	---	
						Eastern white pine	57	
SaA, SaB, SaC Salter Variant	2o	Slight	Slight	Slight	Slight	Sugar maple	64	Red pine, eastern white pine, white spruce.
						Northern red oak	---	
						American basswood	---	
						White oak	---	
ScA Scott Lake	2o	Slight	Slight	Slight	Slight	Northern red oak	65	Eastern white pine, red pine, white spruce, black spruce.
						Yellow birch	---	
						American basswood	---	
						Red maple	---	
						Sugar maple	---	
						Quaking aspen	---	
						Bigtooth aspen	---	
Sd Seelyeville	3w	Slight	Severe	Severe	Severe	Balsam fir	59	
						Black spruce	---	
						Tamarack	50	
						Northern white-cedar	---	
						Black ash	---	
SfB, SfC Shawano	2s	Slight	Slight	Moderate	Slight	Northern red oak	63	Red pine, eastern white pine, jack pine.
						Red pine	---	
						Eastern white pine	---	
						Jack pine	---	
						Paper birch	---	
SfD Shawano	2s	Moderate	Moderate	Moderate	Slight	Northern red oak	63	Red pine, eastern white pine, jack pine.
						Red pine	---	
						Eastern white pine	---	
						Jack pine	---	
						Paper birch	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
SgB*, SgC*:								
Shawano-----------	2s	Slight	Slight	Moderate	Slight	Northern red oak---- Red pine------------ Eastern white pine-- Jack pine----------- Paper birch---------	63 --- --- --- ---	Red pine, eastern white pine, jack pine.
Briggsville-------	2o	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple--------- White ash----------- American basswood---	65 --- --- ---	Eastern white pine, white spruce, red pine.
ShA---------------- Shiocton	2o	Slight	Slight	Slight	Slight	Red maple----------- Sugar maple--------- Northern red oak---- American basswood--- Bigtooth aspen------	65 --- --- --- ---	Eastern white pine, white spruce, silver maple, white ash.
SkA---------------- Shiocton Variant	2o	Slight	Slight	Slight	Slight	Red maple----------- Sugar maple--------- Northern red oak---- American basswood--- American beech------	65 --- --- --- ---	Eastern white pine, white spruce, silver maple, white ash.
SoA---------------- Solona	2o	Slight	Slight	Slight	Slight	Sugar maple--------- Northern red oak---- White ash----------- American basswood---	64 --- --- ---	Eastern white pine, red pine, white spruce.
SyB*:								
Solona------------	2o	Slight	Slight	Slight	Slight	Sugar maple--------- Northern red oak---- White ash----------- American basswood---	64 67 --- ---	Eastern white pine, red pine, white spruce.
Onaway------------	2o	Slight	Slight	Slight	Slight	Sugar maple--------- Yellow birch-------- Northern red oak---- American basswood--- White ash----------- Eastern white pine--	61 --- 69 --- --- ---	White spruce, eastern white pine, red pine.
TlB, TlC2---------- Tilleda	1o	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple--------- Red maple----------- Eastern white pine--	73 69 --- ---	Red pine, eastern white pine, white spruce.
TlD---------------- Tilleda	1r	Moderate	Moderate	Slight	Slight	Northern red oak---- Sugar maple--------- Red maple----------- Eastern white pine--	73 69 --- ---	Red pine, eastern white pine, white spruce.
TvB, TvC2---------- Tilleda Variant	1o	Slight	Slight	Slight	Slight	Northern red oak---- White ash----------- Sugar maple---------	72 --- ---	Red pine, eastern white pine, white spruce.
WaA---------------- Wainola	1s	Slight	Slight	Severe	Slight	Quaking aspen------- White ash----------- Red maple----------- Northern red oak---- Red pine------------	60 --- 77 74 62	White spruce, eastern white pine, red pine.
Wh----------------- Wheatley	4w	Slight	Severe	Severe	Severe	Red maple----------- Quaking aspen------- Balsam fir---------- Northern white-cedar	45 --- --- ---	White spruce, balsam fir.

* 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 heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
AfB: Alban	Manyflower cotoneaster.	Siberian peashrub, eastern redcedar, lilac, silky dogwood, American cranberrybush, Amur maple, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
AgB: Alban Variant	Manyflower cotoneaster.	Eastern redcedar, lilac, Siberian peashrub, silky dogwood, American cranberrybush, Amur maple, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Ah: Angelica	---	White spruce, silky dogwood, black spruce.	Northern white-cedar, white spruce.	---	Carolina poplar.
AtB: Antigo	---	Northern white-cedar, silky dogwood, lilac, American cranberrybush, Amur maple, gray dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine, red maple, white ash.	---
AuA: Au Gres	---	Eastern redcedar, lilac, Amur maple, American cranberrybush, silky dogwood, Siberian peashrub, gray dogwood.	Norway spruce	Red pine, eastern white pine, jack pine.	Carolina poplar.
AxA: Au Gres Variant	Manyflower cotoneaster.	Eastern redcedar, lilac, Amur maple, American cranberrybush, silky dogwood, Siberian peashrub, gray dogwood.	Norway spruce	Red pine, eastern white pine, jack pine.	---
Ba: Bach	---	Silky dogwood, lilac.	Green ash, northern white-cedar, eastern white pine.	---	Carolina poplar.
BrB: Boyer	Manyflower cotoneaster.	Eastern redcedar, lilac, silky dogwood, Siberian peashrub, Amur maple.	Green ash, Norway spruce.	Eastern white pine, red pine, jack pine.	Carolina poplar.
Bs: Brevort	---	Northern white-cedar, silky dogwood, American cranberrybush, nannyberry viburnum.	Eastern white pine, green ash, red maple.	Norway spruce	Carolina poplar.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
BtA, BtB: Briggsville	---	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.	---
BuA: Brill	---	Northern white-cedar, gray dogwood, silky dogwood, lilac, Amur maple, American cranberrybush.	White spruce, Norway spruce.	Eastern white pine, red pine, red maple, white ash.	---
Co. Cormant					
CrB, CrC, CrD: Cromwell	Manyflower cotoneaster.	Eastern redcedar, northern white-cedar, Russian-olive, Siberian peashrub, Amur maple.	Norway spruce	Eastern white pine, red pine.	---
CtA: Croswell	Manyflower cotoneaster.	Lilac, silky dogwood, white spruce, Siberian peashrub, Amur maple, eastern redcedar, northern white-cedar.	Norway spruce	Red pine, eastern white pine.	Carolina poplar.
Dp*. Dumps					
EcD*, EcE*: Elderon	Manyflower cotoneaster.	Eastern redcedar, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	Siberian peashrub.
Rosholt	Manyflower cotoneaster.	Siberian peashrub, lilac, gray dogwood, American cranberrybush, silky dogwood, eastern redcedar, Amur maple.	Norway spruce	Eastern white pine, jack pine, red pine.	---
FpB, FpC: Fairport	Siberian peashrub	Northern white-cedar, gray dogwood, silky dogwood, lilac, Amur maple.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
Fu. Fordum					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Fx. Fluvents					
IsA. Iosco	---	American cranberrybush, silky dogwood, nannyberry viburnum.	White spruce	Green ash, eastern white pine, red pine.	Carolina poplar.
KaB, KaC, KaD, KaE. Kennan					
LvB, LvC. Lorenzo Variant	Manyflower cotoneaster.	Siberian peashrub, lilac, Amur maple, eastern redcedar, silky dogwood, gray dogwood, American cranberrybush.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Lx. Loxley					
MaA*, MaB*, MaC*:					
Mahtomedi	Manyflower cotoneaster.	Siberian peashrub, lilac, Amur maple, eastern redcedar, silky dogwood, gray dogwood, American cranberrybush.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Menahga	Manyflower cotoneaster.	Siberian peashrub, lilac, Amur maple, eastern redcedar, silky dogwood, gray dogwood, American cranberrybush.	Norway spruce	Eastern white pine, red pine, jack pine.	---
MaD*:					
Mahtomedi.					
Menahga.					
McA. Manawa	---	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.	---
Mk*:					
Markey	---	Redosier dogwood, nannyberry viburnum.	Siberian crabapple, Japanese tree lilac.	---	Carolina poplar.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
Mk*: Cathro	---	Redosier dogwood, nannyberry viburnum.	Siberian crabapple, Japanese tree lilac.	---	Carolina poplar.
MnA, MnB, MnC Menahga	Manyflower cotoneaster.	Eastern redcedar, lilac, Siberian peashrub, silky dogwood, Amur maple, gray dogwood, American cranberrybush.	Norway spruce	Eastern white pine, red pine, jack pine.	---
MnD. Menahga					
MsB, MsC, MsD 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	---	Northern white-cedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood, common ninebark.	White spruce	Silver maple, white ash, green ash, red maple.	---
ObA Oesterle	Manyflower cotoneaster.	American cranberrybush, Amur maple, Siberian peashrub, silky dogwood, gray dogwood, eastern redcedar, lilac.	Norway spruce	Eastern white pine, red pine, jack pine.	---
OeB, OeC2, OeD2, OeE Onaway	---	Northern white-cedar, lilac, silky dogwood, American cranberrybush, Amur maple, gray dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine, white ash, red maple.	---
OfB, OfC2 Onaway	---	Northern white-cedar, lilac, silky dogwood, American cranberrybush, Amur maple, gray dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine, white ash, red maple.	---
Pt*. Pits					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
PvA---------------- Plover	Manyflower cotoneaster.	Siberian peashrub, silky dogwood, American cranberrybush, Amur maple, gray dogwood, lilac.	Norway spruce-----	Eastern white pine, jack pine, red pine.	---
RmD*: Rock outcrop.					
Rosholt Variant.					
RoA, RoB, RoC, RoD-------------- Rosholt	Manyflower cotoneaster.	Siberian peashrub, lilac, gray dogwood, American cranberrybush, silky dogwood, eastern redcedar, Amur maple.	Norway spruce-----	Eastern white pine, jack pine, red pine.	---
RpB*, RpC*: Rosholt-----------	Manyflower cotoneaster.	Siberian peashrub, lilac, gray dogwood, American cranberrybush, silky dogwood, eastern redcedar, Amur maple.	Norway spruce-----	Eastern white pine, jack pine, red pine.	---
Elderon-----------	Manyflower cotoneaster.	Eastern redcedar, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	Norway spruce-----	Eastern white pine, red pine, jack pine.	Siberian peashrub.
RrD*: Rosholt-----------	Manyflower cotoneaster.	Siberian peashrub, lilac, gray dogwood, American cranberrybush, silky dogwood, eastern redcedar, Amur maple.	Norway spruce-----	Eastern white pine, jack pine, red pine.	---
Rock outcrop.					
RsA, RsB---------- Rousseau	Manyflower cotoneaster.	Siberian peashrub, lilac, gray dogwood, American cranberrybush, silky dogwood, eastern redcedar, Amur maple.	Norway spruce-----	Eastern white pine, jack pine, red pine.	---
RuB, RuC, RuD----- Rubicon	Manyflower cotoneaster.	Eastern redcedar, Amur maple, lilac, Siberian peashrub, American cranberrybush, silky dogwood, gray dogwood.	Norway spruce-----	Red pine, eastern white pine, jack pine.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
SaA, SaB, SaC: Salter Variant	Manyflower cotoneaster.	Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Sb*. Saprists					
ScA: Scott Lake	---	Northern white-cedar, lilac, silky dogwood, American cranberrybush, Amur maple, gray dogwood.	White spruce, Norway spruce.	Eastern white pine, white ash, red pine, red maple.	---
Sd: Seelyeville	---	Common ninebark, gray dogwood, nannyberry viburnum.	Japanese tree lilac.	---	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.	---
SgB*, SgC*:					
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.	---
Briggsville	---	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.	---
ShA: Shiocton	---	Lilac, silky dogwood, Siberian peashrub, Amur maple, nannyberry viburnum.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, green ash, silver maple.	---
SkA: Shiocton Variant	---	Lilac, silky dogwood, Siberian peashrub, nannyberry viburnum, Amur maple, gray dogwood.	White spruce, Norway spruce, Black Hills spruce.	Eastern white pine, red pine, green ash.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
SoA: Solona	Manyflower cotoneaster.	Lilac, eastern redcedar, silky dogwood, Siberian peashrub, American cranberrybush, Amur maple, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
SyB*: Solona	Manyflower cotoneaster.	Lilac, silky dogwood, American cranberrybush, Amur maple, gray dogwood, northern white-cedar.	---	Eastern white pine, red pine, red maple, white ash.	---
Onaway	---	Northern white-cedar, lilac, American cranberrybush, Amur maple, silky dogwood, gray dogwood.	White spruce, Norway spruce.	Red pine, eastern white pine, red maple, white ash.	---
TlB, TlC2, TlD: Tilleda	---	Northern white-cedar, lilac, American cranberrybush, gray dogwood, silky dogwood, Amur maple.	White spruce, Norway spruce.	Eastern white pine, red pine, red maple, white ash.	---
TvB, TvC2: Tilleda Variant	---	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.	---
WaA: Wainola	---	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.	---
Wh: Wheatley	---	Northern white-cedar, lilac, American cranberrybush, nannyberry viburnum, silky dogwood, redosier dogwood, common ninebark.	White spruce	Silver maple, white ash, green ash, red maple.	---

* 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
AfB-------------------- Alban	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
AgB-------------------- Alban Variant	Slight----------	Slight----------	Moderate: slope.	Slight------------	Moderate: droughty.
Ah--------------------- Angelica	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
AtB-------------------- Antigo	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
AuA-------------------- Au Gres	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
AxA-------------------- Au Gres Variant	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Ba--------------------- Bach	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
BrB-------------------- Boyer	Slight----------	Slight----------	Moderate: slope, small stones.	Slight------------	Slight.
Bs--------------------- Brevort	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
BtA-------------------- Briggsville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Severe: erodes easily.	Slight.
BtB-------------------- Briggsville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
BuA-------------------- Brill	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
Co--------------------- Cormant	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
CrB-------------------- Cromwell	Slight----------	Slight----------	Moderate: slope.	Slight------------	Moderate: droughty.
CrC-------------------- Cromwell	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: droughty, slope.
CrD-------------------- Cromwell	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
CtA-------------------- Croswell	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight------------	Moderate: droughty.
Dp*. Dumps					

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
EcD*:					
Elderon	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, droughty, slope.
Rosholt	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
EcE*:					
Elderon	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, droughty, slope.
Rosholt	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
FpB Fairport	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight	Moderate: thin layer.
FpC Fairport	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, thin layer.
Fu Fordum	Severe: flooding, ponding.	Severe: ponding.	Severe: small stones, ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
Fx. Fluvents					
IsA Iosco	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
KaB Kennan	Slight	Slight	Severe: large stones.	Moderate: large stones.	Severe: large stones.
KaC Kennan	Moderate: slope.	Moderate: slope.	Severe: large stones, slope.	Moderate: large stones.	Severe: large stones.
KaD Kennan	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: large stones, slope.	Severe: large stones, slope.
KaE Kennan	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: slope.	Severe: large stones, slope.
LvB Lorenzo Variant	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
LvC Lorenzo Variant	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, 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.

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
MaA*:					
Mahtomedi	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, droughty.
Menahga	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
MaB*:					
Mahtomedi	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, droughty.
Menahga	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: too sandy.
MaC*:					
Mahtomedi	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, droughty, slope.
Menahga	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: slope, too sandy.
MaD*:					
Mahtomedi	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Slight	Severe: slope.
Menahga	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
McA Manawa	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Mk*:					
Markey	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Cathro	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
MnA Menahga	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
MnB Menahga	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: too sandy.
MnC Menahga	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: slope, too sandy.
MnD Menahga	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
MsB Menominee	Slight	Slight	Moderate: slope.	Slight	Moderate: 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
MsC-------------------- Menominee	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: droughty, slope.
MsD-------------------- Menominee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Mu--------------------- Minocqua	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
ObA-------------------- Oesterle	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness, droughty.
OeB-------------------- Onaway	Slight----------	Slight----------	Moderate: slope, small stones.	Moderate: large stones.	Moderate: large stones.
OeC2------------------- Onaway	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: large stones.	Moderate: large stones, slope.
OeD2------------------- Onaway	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: large stones, slope.	Severe: slope.
OeE-------------------- Onaway	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
OfB-------------------- Onaway	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
OfC2------------------- Onaway	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.
Pt*. Pits					
PvA-------------------- Plover	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
RmD*: Rock outcrop.					
Rosholt Variant------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
RoA, RoB--------------- Rosholt	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight------------	Moderate: small stones, droughty.
RoC-------------------- Rosholt	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight------------	Moderate: small stones, droughty, slope.
RoD-------------------- Rosholt	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
RpB*: Rosholt--------------	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight------------	Moderate: small stones, 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
RpB*:					
Elderon	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones, droughty.
RpC*:					
Rosholt	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, droughty, slope.
Elderon	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, droughty.
RrD*:					
Rosholt	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
Rock outcrop.					
RsA Rousseau	Slight	Slight	Slight	Slight	Moderate: droughty.
RsB Rousseau	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
RuB Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
RuC Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
RuD Rubicon	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty, slope.
SaA Salter Variant	Slight	Slight	Slight	Slight	Slight.
SaB Salter Variant	Slight	Slight	Moderate: slope.	Slight	Slight.
SaC Salter Variant	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Sb*. Saprists					
ScA Scott Lake	Slight	Slight	Moderate: small stones.	Slight	Moderate: large stones.
Sd Seelyeville	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
SfB Shawano	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
SfC Shawano	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
SfD Shawano	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: 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
SgB*:					
Shawano	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Briggsville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
SgC*:					
Shawano	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Briggsville	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
ShA Shiocton	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
SkA Shiocton Variant	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
SoA Solona	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
SyB*:					
Solona	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Onaway	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly, slope.	Moderate: large stones.	Moderate: large stones.
TlB Tilleda	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
TlC2 Tilleda	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
TlD Tilleda	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
TvB Tilleda Variant	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
TvC2 Tilleda Variant	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
WaA Wainola	Severe: wetness, too sandy.	Severe: too sandy.	Severe: too sandy, wetness.	Severe: too sandy.	Moderate: wetness, droughty.
Wh Wheatley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 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: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
AfB: Alban	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AgB: Alban Variant	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ah: Angelica	Good	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
AtB: Antigo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AuA: Au Gres	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
AxA: Au Gres Variant	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Ba: Bach	Good	Good	Poor	Poor	Poor	Good	Good	Good	Poor	Good.
BrB: Boyer	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Bs: Brevort	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Poor.
BtA, BtB: Briggsville	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
BuA: Brill	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Co: Cormant	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
CrB, CrC: Cromwell	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
CrD: Cromwell	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
CtA: Croswell	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
Dp*. Dumps										
EcD*:										
Elderon	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rosholt	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
EcE*:										
Elderon	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rosholt	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
FpB, FpC----------- Fairport	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Fu----------------- Fordum	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
Fx. Fluvents										
IsA---------------- Iosco	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
KaB, KaC, KaD, KaE- Kennan	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
LvB, LvC----------- Lorenzo Variant	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Lx----------------- Loxley	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
MaA*, MaB*, MaC*:										
Mahtomedi---------	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Menahga-----------	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
MaD*:										
Mahtomedi---------	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Menahga-----------	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
McA---------------- Manawa	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Mk*:										
Markey------------	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Fair.
Cathro------------	Poor	Fair	Fair	Fair	Fair	Good	Good	Poor	Poor	Good.
MnA, 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.
MsB, MsC, MsD------ 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.
ObA---------------- Oesterle	Fair	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	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.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
OeE----------------- Onaway	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
OfB----------------- Onaway	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OfC2---------------- Onaway	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Pt*. Pits										
PvA----------------- Plover	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
RmD*: Rock outcrop.										
Rosholt Variant---	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
RoA, RoB----------- Rosholt	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RoC----------------- Rosholt	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
RoD----------------- Rosholt	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
RpB*: Rosholt-----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Elderon-----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
RpC*: Rosholt-----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Elderon-----------	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
RrD*: Rosholt-----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rock outcrop.										
RsA, RsB----------- Rousseau	Poor	Poor	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Poor.
RuB----------------- Rubicon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
RuC, RuD----------- Rubicon	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
SaA, SaB, SaC------ Salter Variant	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Sb*. Saprists										
ScA----------------- Scott Lake	Fair	Good	Good	Good	Good	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: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
Sd----------------- Seelyeville	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	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.
SgB*:										
Shawano-----------	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Briggsville-------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
SgC*:										
Shawano-----------	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Briggsville-------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ShA---------------- Shiocton	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
SkA---------------- Shiocton Variant	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
SoA---------------- Solona	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
SyB*:										
Solona------------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Onaway------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
TlB---------------- Tilleda	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Very poor.
TlC2--------------- Tilleda	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
TlD---------------- Tilleda	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
TvB, TvC2---------- Tilleda Variant	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WaA---------------- Wainola	Poor	Poor	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor.
Wh----------------- Wheatley	Very poor.	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	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]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AfB: Alban	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Slight.
AgB: Alban Variant	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Slight	Moderate: droughty.
Ah: Angelica	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
AtB: Antigo	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
AuA: Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
AxA: Au Gres Variant	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
Ba: Bach	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
BrB: Boyer	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
Bs: Brevort	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
BtA: Briggsville	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
BtB: Briggsville	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
BuA: Brill	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
Co: Cormant	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.
CrB: Cromwell	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
CrC: Cromwell	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
CrD: Cromwell	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CtA: Croswell	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty.

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
Dp*. Dumps						
EcD*, EcE*:						
Elderon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.
Rosholt	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
FpB Fairport	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Moderate: thin layer.
FpC Fairport	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
Fu Fordum	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding, frost action.	Severe: ponding, flooding.
Fx. Fluvents						
IsA Iosco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
KaB Kennan	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: frost action, large stones.	Severe: large stones.
KaC Kennan	Moderate: dense layer, large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, frost action, large stones.	Severe: large stones.
KaD, KaE Kennan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.
LvB Lorenzo Variant	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
LvC Lorenzo Variant	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Lx Loxley	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: too acid, ponding, excess humus.
MaA*:						
Mahtomedi	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: small stones, droughty.
Menahga	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: too sandy.

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
MaB*:						
Mahtomedi	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: small stones, droughty.
Menahga	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: too sandy.
MaC*:						
Mahtomedi	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, droughty, slope.
Menahga	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, too sandy.
MaD*:						
Mahtomedi	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.
McA Manawa	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
Mk*:						
Markey	Severe: cutbanks cave, excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
Cathro	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
MnA Menahga	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: too sandy.
MnB Menahga	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: too sandy.
MnC Menahga	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, too sandy.
MnD Menahga	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MsB Menominee	Slight	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
MsC Menominee	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
MsD Menominee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mu Minocqua	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding, frost action.	Severe: ponding.

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
ObA--------------- Oesterle	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: frost action.	Moderate: large stones, wetness, droughty.
OeB--------------- Onaway	Moderate: dense layer.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
OeC2-------------- Onaway	Moderate: dense layer, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
OeD2, OeE--------- Onaway	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
OfB--------------- Onaway	Moderate: large stones.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
OfC2-------------- Onaway	Moderate: large stones, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Pt*. Pits						
PvA--------------- Plover	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: frost action.	Moderate: wetness.
RmD*: Rock outcrop.						
Rosholt Variant--	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
RoA--------------- Rosholt	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: small stones, droughty.
RoB--------------- Rosholt	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: small stones, droughty.
RoC--------------- Rosholt	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: small stones, droughty, slope.
RoD--------------- Rosholt	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
RpB*: Rosholt----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: small stones, droughty.
Elderon----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Severe: small stones, droughty.
RpC*: Rosholt----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: small 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
RpC*:						
Elderon----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: small stones, droughty.
RrD*:						
Rosholt----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
RsA--------------- Rousseau	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty.
RsB--------------- Rousseau	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Moderate: slope.	Slight---------	Moderate: droughty.
RuB--------------- Rubicon	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
RuC--------------- Rubicon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
RuD--------------- Rubicon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
SaA--------------- Salter Variant	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Slight.
SaB--------------- Salter Variant	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Slight.
SaC--------------- Salter Variant	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Sb*. Saprists						
ScA--------------- Scott Lake	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Moderate: large stones.
Sd---------------- Seelyeville	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
SfB--------------- Shawano	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	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.
SgB*:						
Shawano----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
Briggsville------	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.

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
SgC*:						
Shawano----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Briggsville------	Moderate: too clayey, dense layer, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
ShA--------------- Shiocton	Severe: wetness, cutbanks cave.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: frost action, flooding.	Moderate: wetness, flooding.
SkA--------------- Shiocton Variant	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: frost action.	Moderate: wetness.
SoA--------------- Solona	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: frost action.	Moderate: wetness.
SyB*:						
Solona-----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: frost action.	Moderate: wetness.
Onaway-----------	Moderate: dense layer, wetness.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Slight.
TlB--------------- Tilleda	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Moderate: large stones.
TlC2-------------- Tilleda	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: large stones, slope.
TlD--------------- Tilleda	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
TvB--------------- Tilleda Variant	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Moderate: large stones.
TvC2-------------- Tilleda Variant	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: large stones, slope.
WaA--------------- Wainola	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Wh---------------- Wheatley	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AfB: Alban	Severe: wetness.	Severe: wetness.	Moderate: wetness, too sandy.	Slight	Fair: too sandy, wetness.
AgB: Alban Variant	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy.
Ah: Angelica	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
AtB: Antigo	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
AuA: Au Gres	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
AxA: Au Gres Variant	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
Ba: Bach	Severe: ponding.	Severe: ponding.	Severe: ponding, too sandy.	Severe: ponding.	Poor: ponding.
BrB: Boyer	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Bs: Brevort	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
BtA: Briggsville	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BtB: Briggsville	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BuA: Brill	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
Co: Cormant	Severe: ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
CrB: Cromwell	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote 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
CrC------------------ Cromwell	Severe: poor filter*.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
CrD------------------ Cromwell	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
CtA------------------ Croswell	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Dp**. Dumps					
EcD**, EcE**:					
Elderon-------------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Rosholt-------------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
FpB------------------ Fairport	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
FpC------------------ Fairport	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Fu------------------- Fordum	Severe: flooding, ponding, poor filter.	Severe: seepage, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, ponding.
Fx. Fluvents					
IsA------------------ Iosco	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
KaB------------------ Kennan	Moderate: large stones.	Severe: seepage, large stones.	Severe: seepage.	Severe: seepage.	Poor: seepage.
KaC------------------ Kennan	Moderate: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage.	Severe: seepage.	Poor: seepage.
KaD, KaE------------- Kennan	Severe: slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
LvB------------------ Lorenzo Variant	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, 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
LvC: Lorenzo Variant	Severe: poor filter*.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Lx: Loxley	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
MaA**, MaB**:					
Mahtomedi	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Menahga	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MaC**:					
Mahtomedi	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.
MaD**:					
Mahtomedi	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.
McA: Manawa	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Mk**:					
Markey	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Cathro	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
MnA, 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.

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
MnD----------------- Menahga	Severe: poor filter*, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
MsB----------------- Menominee	Slight-----------	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: too sandy.
MsC----------------- Menominee	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: too sandy.
MsD----------------- Menominee	Severe: slope.	Severe: seepage, slope.	Severe: too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope.
Mu------------------ Minocqua	Severe: flooding, ponding, poor filter.	Severe: seepage, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, small stones.
ObA----------------- Oesterle	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
OeB----------------- Onaway	Moderate: percs slowly.	Moderate: seepage, slope, large stones.	Moderate: large stones.	Slight-----------	Fair: large stones.
OeC2---------------- Onaway	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, large stones.	Moderate: slope.	Fair: large stones, slope.
OeD2, OeE----------- Onaway	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
OfB----------------- Onaway	Moderate: percs slowly, large stones.	Moderate: seepage, slope.	Moderate: large stones.	Slight-----------	Poor: large stones.
OfC2---------------- Onaway	Moderate: percs slowly, slope, large stones.	Severe: slope.	Moderate: slope, large stones.	Moderate: slope.	Poor: large stones.
Pt**. Pits					
PvA----------------- Plover	Severe: wetness.	Severe: flooding, wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.
RmD**: Rock outcrop.					
Rosholt Variant----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
RoA, RoB------------ Rosholt	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, 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
RoC------------------ Rosholt	Severe: poor filter*.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
RoD------------------ Rosholt	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
RpB**:					
Rosholt------------	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Elderon------------	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
RpC**:					
Rosholt------------	Severe: poor filter*.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Elderon------------	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
RrD**:					
Rosholt------------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Rock outcrop.					
RsA, RsB------------ Rousseau	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
RuB------------------ Rubicon	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
RuC------------------ Rubicon	Severe: poor filter*.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
RuD------------------ Rubicon	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
SaA, SaB------------ Salter Variant	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Fair: too sandy, wetness.
SaC------------------ Salter Variant	Moderate: slope.	Severe: slope.	Severe: too sandy.	Moderate: slope.	Fair: too sandy, slope.
Sb**. Saprists					

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
ScA: Scott Lake	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
Sd: Seelyeville	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding, excess humus.
SfB: Shawano	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
SfC: Shawano	Severe: poor filter*.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
SfD: Shawano	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
SgB**:					
Shawano	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Briggsville	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
SgC**:					
Shawano	Severe: poor filter*.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Briggsville	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
ShA: Shiocton	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.	Severe: flooding, wetness.	Poor: wetness.
SkA: Shiocton Variant	Severe: wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Poor: large stones, wetness.
SoA: Solona	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
SyB**:					
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.
TlB: Tilleda	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
TlC2: Tilleda	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, 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
TlD------------------ Tilleda	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
TvB------------------ Tilleda Variant	Severe: poor filter*.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
TvC2----------------- Tilleda Variant	Severe: poor filter*.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
WaA------------------ Wainola	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.
Wh------------------- Wheatley	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.

* The effluent drains satisfactorily but there is a danger of ground water pollution.

** 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," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AfB: Alban	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
AgB: Alban Variant	Fair: wetness.	Probable	Improbable: too sandy.	Poor: thin layer.
Ah: Angelica	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, wetness.
AtB: Antigo	Good	Probable	Probable	Poor: area reclaim, small stones.
AuA: Au Gres	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
AxA: Au Gres Variant	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
Ba: Bach	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
BrB: Boyer	Good	Probable	Probable	Poor: small stones, area reclaim.
Bs: Brevort	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
BtA, BtB: Briggsville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
BuA: Brill	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
Co: Cormant	Poor: wetness.	Probable	Improbable: too sandy.	Poor: thin layer, wetness.
CrB, CrC: Cromwell	Good	Probable	Improbable: too sandy.	Poor: small stones.
CrD: Cromwell	Fair: slope.	Probable	Improbable: too sandy.	Poor: small stones, slope.
CtA: Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
Dp*. Dumps				
EcD*:				
Elderon	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EcD*:				
Rosholt	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
EcE*:				
Elderon	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Rosholt	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
FpB, FpC Fairport	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Fu Fordum	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, wetness.
Fx. Fluvents				
IsA Iosco	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy.
KaB, KaC Kennan	Fair: large stones.	Probable	Improbable: too sandy.	Poor: large stones.
KaD Kennan	Fair: large stones, slope.	Probable	Improbable: too sandy.	Poor: large stones, slope.
KaE Kennan	Poor: slope.	Probable	Improbable: too sandy.	Poor: large stones, slope.
LvB, LvC Lorenzo Variant	Good	Probable	Probable	Poor: area reclaim, small stones.
Lx Loxley	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness, too acid.
MaA*, MaB*, MaC*:				
Mahtomedi	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.
Menahga	Good	Probable	Improbable: too sandy.	Poor: too sandy.
MaD*:				
Mahtomedi	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MaD*:				
Menahga	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
McA. Manawa	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Mk*:				
Markey	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
MnA, MnB, MnC. Menahga	Good	Probable	Improbable: too sandy.	Poor: too sandy.
MnD. Menahga	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
MsB, MsC. Menominee	Good	Improbable: thin layer.	Improbable: excess fines.	Poor: thin layer.
MsD. Menominee	Fair: slope.	Improbable: thin layer.	Improbable: excess fines.	Poor: thin layer.
Mu. Minocqua	Poor: wetness.	Probable	Probable	Poor: small stones, area reclaim, wetness.
ObA. Oesterle	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim.
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.
OfB, OfC2. Onaway	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.
Pt*. Pits				
PvA. Plover	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
RmD*:				
Rock outcrop.				
Rosholt Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RoA, RoB, RoC: Rosholt	Good	Probable	Probable	Poor: small stones, area reclaim.
RoD: Rosholt	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
RpB*, RpC*:				
Rosholt	Good	Probable	Probable	Poor: small stones, area reclaim.
Elderon	Good	Probable	Probable	Poor: small stones, area reclaim.
RrD*:				
Rosholt	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Rock outcrop.				
RsA, RsB: Rousseau	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
RuB, RuC: Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
RuD: Rubicon	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
SaA, SaB: Salter Variant	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
SaC: Salter Variant	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
Sb*. Saprists				
ScA: Scott Lake	Good	Probable	Probable	Poor: small stones, area reclaim.
Sd: Seelyeville	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
SfB: Shawano	Good	Probable	Improbable: too sandy.	Fair: area reclaim, too sandy.
SfC: Shawano	Good	Probable	Improbable: too sandy.	Fair: area reclaim, too sandy, slope.
SfD: Shawano	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SgB*:				
Shawano	Good	Probable	Improbable: too sandy.	Fair: area reclaim, too sandy.
Briggsville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
SgC*:				
Shawano	Good	Probable	Improbable: too sandy.	Fair: area reclaim, too sandy, slope.
Briggsville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
ShA Shiocton	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
SkA Shiocton Variant	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
SoA Solona	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
SyB*:				
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.
TlB Tilleda	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
TlC2 Tilleda	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
TlD Tilleda	Fair: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
TvB, TvC2 Tilleda Variant	Good	Probable	Probable	Poor: small stones, area reclaim.
WaA Wainola	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Wh Wheatley	Poor: 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]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AfB: Alban	Moderate: seepage, slope.	Severe: seepage, piping.	Deep to water	Soil blowing, rooting depth, slope.	Too sandy, soil blowing.	Rooting depth.
AgB: Alban Variant	Severe: seepage.	Severe: piping.	Slope, cutbanks cave.	Wetness, droughty, fast intake.	Erodes easily, wetness, too sandy.	Erodes easily, droughty, rooting depth.
Ah: Angelica	Slight	Severe: piping, ponding.	Ponding, frost action.	Ponding, rooting depth.	Ponding	Wetness, rooting depth.
AtB: Antigo	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, erodes easily.	Erodes easily, too sandy.	Erodes easily.
AuA: Au Gres	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
AxA: Au Gres Variant	Severe: seepage.	Severe: seepage, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Ba: Bach	Moderate: seepage.	Severe: piping, ponding.	Ponding, frost action, cutbanks cave.	Ponding, rooting depth.	Ponding	Wetness, rooting depth.
BrB: Boyer	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, slope.	Too sandy, soil blowing.	Droughty.
Bs: Brevort	Severe: seepage.	Severe: piping, ponding.	Ponding, frost action.	Ponding, droughty, fast intake.	Ponding, soil blowing.	Wetness, droughty.
BtA: Briggsville	Slight	Moderate: hard to pack.	Deep to water	Rooting depth, erodes easily.	Erodes easily	Erodes easily, rooting depth.
BtB: Briggsville	Moderate: slope.	Moderate: hard to pack.	Deep to water	Rooting depth, slope, erodes easily.	Erodes easily	Erodes easily, rooting depth.
BuA: Brill	Severe: seepage.	Severe: seepage, piping.	Cutbanks cave, frost action.	Wetness	Erodes easily, wetness, too sandy.	Erodes easily.
Co: Cormant	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
CrB: Cromwell	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
CrC, CrD: Cromwell	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
CtA: Croswell	Severe: seepage.	Severe: seepage.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy.	Droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Dp*. Dumps						
EcD*, EcE*:						
Elderon	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Rosholt	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
FpB Fairport	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Soil blowing, depth to rock, rooting depth.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
FpC Fairport	Severe: slope.	Severe: thin layer.	Deep to water	Soil blowing, depth to rock, rooting depth.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Fu Fordum	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, flooding, frost action.	Ponding, flooding.	Ponding, too sandy.	Wetness.
Fx. Fluvents						
IsA Iosco	Severe: seepage.	Severe: piping, wetness.	Favorable	Wetness, droughty, fast intake.	Wetness, soil blowing.	Wetness, droughty.
KaB Kennan	Severe: seepage.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Large stones	Large stones, droughty.
KaC, KaD, KaE Kennan	Severe: seepage, slope.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
LvB Lorenzo Variant	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, rooting depth.	Too sandy, soil blowing.	Droughty, rooting depth.
LvC Lorenzo Variant	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, rooting depth.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
Lx Loxley	Severe: seepage.	Severe: excess humus, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing, too acid.	Ponding, soil blowing.	Wetness.
MaA*, MaB*:						
Mahtomedi	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
Menahga	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
MaC*, MaD*:						
Mahtomedi	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
Menahga	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
McA: Manawa	Slight	Severe: hard to pack.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, rooting depth, percs slowly.
Mk*:						
Markey	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
Cathro	Severe: seepage.	Severe: piping, ponding.	Ponding, subsides, frost action.	Ponding, soil blowing, rooting depth.	Ponding, soil blowing.	Wetness, rooting depth.
MnA, 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.
MsB: Menominee	Severe: seepage.	Severe: piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
MsC, MsD: 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, ponding.	Ponding, flooding, frost action.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty.
ObA: Oesterle	Severe: seepage.	Severe: seepage, wetness.	Frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
OeB: Onaway	Moderate: seepage, slope.	Severe: piping.	Deep to water	Droughty, soil blowing, rooting depth.	Large stones, soil blowing.	Large stones, droughty.
OeC2, OeD2, OeE: Onaway	Severe: slope.	Severe: piping.	Deep to water	Droughty, soil blowing, rooting depth.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
OfB: Onaway	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Large stones, soil blowing.	Large stones.
OfC2: Onaway	Severe: slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope.
Pt*. Pits						
PvA: Plover	Moderate: seepage.	Severe: piping, wetness.	Frost action, cutbanks cave.	Wetness	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
RmD*:						
Rock outcrop.						
Rosholt Variant	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
RoA: Rosholt	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
RoB---------------- Rosholt	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
RoC, RoD---------- Rosholt	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
RpB*:						
Rosholt----------	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
Elderon----------	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Large stones, too sandy.	Large stones, droughty.
RpC*:						
Rosholt----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
Elderon----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones, too sandy.	Large stones, slope, droughty.
RrD*:						
Rosholt----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
Rock outcrop.						
RsA---------------- Rousseau	Severe: seepage.	Severe: seepage, piping.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
RsB---------------- Rousseau	Severe: seepage.	Severe: seepage, piping.	Slope, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
RuB---------------- Rubicon	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
RuC, RuD---------- Rubicon	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
SaA---------------- Salter Variant	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing, rooting depth.	Erodes easily, soil blowing.	Erodes easily, rooting depth.
SaB---------------- Salter Variant	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, rooting depth, slope.	Erodes easily, soil blowing.	Erodes easily, rooting depth.
SaC---------------- Salter Variant	Severe: slope.	Severe: piping.	Deep to water	Soil blowing, rooting depth, slope.	Slope, erodes easily, soil blowing.	Slope, erodes easily, rooting depth.
Sb*. Saprists						
ScA---------------- Scott Lake	Severe: seepage.	Severe: seepage.	Deep to water	Rooting depth	Large stones, erodes easily, too sandy.	Large stones, erodes easily.
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-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
SfB: Shawano	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
SfC, SfD: Shawano	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
SgB*:						
Shawano	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Briggsville	Moderate: slope.	Moderate: hard to pack.	Deep to water	Rooting depth, slope, erodes easily.	Erodes easily	Erodes easily, rooting depth.
SgC*:						
Shawano	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Briggsville	Severe: slope.	Moderate: hard to pack.	Deep to water	Rooting depth, slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
ShA: Shiocton	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Flooding, wetness.	Wetness, erodes easily.	Wetness, erodes easily.
SkA: Shiocton Variant	Moderate: seepage.	Severe: piping, wetness.	Large stones, frost action.	Wetness	Large stones, wetness.	Large stones, wetness.
SoA: Solona	Moderate: seepage.	Severe: piping, wetness.	Frost action	Wetness, rooting depth.	Wetness	Wetness, rooting depth.
SyB*:						
Solona	Moderate: seepage.	Severe: piping, wetness.	Frost action	Wetness, rooting depth.	Wetness	Wetness, rooting depth.
Onaway	Moderate: slope.	Severe: piping.	Slope	Wetness	Large stones, wetness.	Large stones.
TlB: Tilleda	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
TlC2, TlD: Tilleda	Severe: slope.	Moderate: piping.	Deep to water	Soil blowing, slope.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
TvB: Tilleda Variant	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
TvC2: Tilleda Variant	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Soil blowing, slope.	Slope, too sandy, soil blowing.	Slope.
WaA: Wainola	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Wh: Wheatley	Severe: seepage.	Severe: seepage, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.

* 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: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
AfB--------------	0-7	Fine sandy loam	ML, SM	A-2, A-4	0	100	100	65-85	30-55	<20	1-4
Alban	7-38	Fine sandy loam, very fine sandy loam, loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	60-95	30-65	<25	3-7
	38-60	Stratified very fine sandy loam to very fine sand.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	75-100	12-100	<25	NP-6
AgB--------------	0-9	Loamy sand--------	SM	A-2, A-4	0	100	100	50-90	15-40	---	NP
Alban Variant	9-22	Sand, loamy sand	SM, SP-SM	A-2, A-3	0	100	100	50-75	5-30	---	NP
	22-25	Loam, sandy loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-2	0	100	100	60-100	30-90	<26	4-8
	25-44	Stratified silt loam to sand.	SM, ML	A-4, A-2	0	100	100	60-95	30-90	<21	1-4
	44-60	Sand, loamy sand	SM, SP-SM	A-2, A-3	0	100	100	50-75	5-30	---	NP
Ah---------------	0-9	Silt loam---------	ML	A-4, A-6	0-10	90-100	85-100	80-100	55-90	25-40	2-13
Angelica	9-23	Sandy clay loam, loam, clay loam.	SC, CL, SM-SC, CL-ML	A-2-4, A-6, A-4, A-2-6	0-10	90-100	85-100	70-100	25-90	15-40	5-23
	23-60	Loam, sandy loam, gravelly loam.	ML, SM, CL, SC	A-2-4, A-4, A-6, A-2-6	0-15	85-100	80-100	50-100	30-90	20-40	NP-16
AtB--------------	0-8	Silt loam---------	ML, CL-ML	A-4	0-3	95-100	90-100	90-100	85-90	<25	2-7
Antigo	8-14	Silt loam---------	ML, CL-ML	A-4	0-3	95-100	90-100	90-100	85-95	<25	2-6
	14-33	Silt loam, silty clay loam.	CL	A-6, A-7	0-3	95-100	90-100	90-100	85-95	30-45	10-25
	33-37	Sandy loam, loam, loamy sand.	SM, GM, ML, GM-GC	A-2, A-4, A-1	0-9	50-100	45-100	30-95	15-75	<25	NP-7
	37-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-2, A-3, A-1	0-9	30-100	25-100	10-70	1-12	---	NP
AuA--------------	0-8	Loamy sand--------	SM, SP-SM	A-2-4	0	95-100	90-100	50-75	10-25	---	NP
Au Gres	8-37	Sand, loamy sand	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	37-60	Sand--------------	SP, SP-SM	A-3, A-2-4	0	95-100	90-100	50-90	0-10	---	NP
AxA--------------	0-9	Loamy fine sand	SM	A-2, A-4	0	100	100	50-85	15-40	---	NP
Au Gres Variant	9-14	Fine sand, sand, loamy fine sand.	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-90	5-50	---	NP
	14-28	Fine sand, sand, loamy sand.	SM, SP-SM	A-1-B, A-2, A-3	0	80-100	75-100	40-80	5-35	---	NP
	28-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-1-A, A-1-B	0-5	45-75	40-70	20-50	0-10	---	NP
Ba---------------	0-8	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	65-90	20-35	2-12
Bach	8-60	Very fine sandy loam, silt loam, loamy very fine sand.	ML, SM	A-2-4, A-4	0	100	80-100	70-95	25-95	<35	NP-4
BrB--------------	0-7	Sandy loam--------	SM, SM-SC	A-2, A-4	0-5	95-100	75-95	60-75	25-40	<25	NP-7
Boyer	7-28	Sandy loam, loam, gravelly sandy loam.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	28-60	Gravelly sand, coarse sand, gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Bs---------------- Brevort	0-8	Mucky loamy sand	SP, SM, SP-SM	A-2-4, A-3	0-5	95-100	95-100	50-75	0-30	---	NP
	8-21	Sand, loamy sand, loamy fine sand.	SP, SM, SP-SM	A-2-4, A-3	0-5	95-100	95-100	50-75	0-30	<20	NP-4
	21-60	Silt loam, clay loam, loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	95-100	85-100	55-95	17-45	4-22
BtA, BtB--------- Briggsville	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-40	5-15
	8-28	Silty clay, silty clay loam.	CH, CL	A-6, A-7	0	100	100	95-100	95-100	35-65	15-40
	28-60	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	90-100	30-60	10-35
BuA--------------- Brill	0-7	Silt loam--------	ML, CL-ML	A-4	0-2	95-100	90-100	90-100	85-90	<25	2-7
	7-12	Silt loam, silt	ML, CL-ML	A-4	0-2	95-100	90-100	90-100	85-100	<23	2-6
	12-34	Silt loam, silty clay loam.	CL	A-6, A-7	0-2	95-100	90-100	85-100	85-95	25-45	10-23
	34-38	Silt loam, loam, gravelly sandy loam.	ML, CL-ML, GM, GM-GC	A-4, A-2, A-1	0-6	50-100	45-100	30-95	15-75	<25	NP-7
	38-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-2, A-3, A-1	0-7	30-100	25-100	10-70	1-12	---	NP
Co---------------- Cormant	0-8	Mucky loamy fine sand.	SM, SP-SM	A-2, A-4, A-3	0	100	100	80-100	5-40	---	NP
	8-60	Fine sand, sand, loamy fine sand.	SP, SP-SM, SM	A-2, A-3	0	100	100	70-100	1-20	---	NP
CrB, CrC, CrD---- Cromwell	0-17	Sandy loam-------	SM	A-4, A-2	0	95-100	90-100	55-85	20-45	<20	NP
	17-60	Sand, coarse sand, loamy sand.	SM, SP, SP-SM	A-1, A-3, A-2	0	95-100	60-100	35-70	0-30	<20	NP
CtA--------------- Croswell	0-22	Loamy sand-------	SM	A-2	0	100	95-100	50-75	15-30	<20	NP-4
	22-36	Sand-------------	SP-SM, SM	A-3, A-2-4	0	100	95-100	50-70	5-25	---	NP
	36-60	Sand-------------	SP-SM, SM	A-3, A-2-4	0	100	95-100	50-70	5-25	---	NP
Dp*. Dumps											
EcD*, EcE*: Elderon----------	0-7	Gravelly sandy loam.	SM, SP-SM, GM, GP-GM	A-1, A-2, A-4	5-25	30-95	30-95	20-70	10-40	<20	NP-4
	7-15	Very cobbly coarse sandy loam, very cobbly loamy coarse sand.	SM, SP-SM, GM, GP-GM	A-1	5-25	30-70	30-70	15-50	5-25	<25	NP-4
	15-44	Very cobbly loamy coarse sand, gravelly coarse sand, very cobbly sand.	SM, SP, GM, GP	A-1	5-25	30-70	30-70	10-50	1-25	---	NP
	44-60	Very cobbly coarse sand, cobbly coarse sand, gravelly sand.	SM, SP, GM, GP	A-1	5-25	30-70	25-70	10-50	1-20	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
EcD*, EcE*: Rosholt----------	0-8	Sandy loam--------	SM, SM-SC	A-2, A-1, A-4	0	75-100	70-100	45-70	20-40	<25	NP-4
	8-13	Loam, fine sandy loam, sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4, A-1	0	75-100	70-100	35-95	12-75	<25	NP-6
	13-28	Sandy loam, loam	SM-SC, SM, CL-ML, ML	A-2, A-4, A-1	0-5	75-100	70-100	45-95	20-75	<25	NP-6
	28-34	Gravelly loamy sand, loamy sand, sandy loam.	SM, GM, SP-SM, GP-GM	A-1, A-2	0-10	50-100	45-100	25-75	10-40	<25	NP-4
	34-60	Stratified sand to gravel.	GP, SP, SP-SM, GP-GM	A-1, A-2, A-3	0-25	20-100	20-100	10-65	0-10	---	NP
FpB, FpC---------- Fairport	0-11	Fine sandy loam	SM, SM-SC, SC	A-4, A-2	0-2	85-95	75-95	45-85	25-50	<20	NP-10
	11-30	Clay loam, sandy clay loam, loam.	CL	A-6	0-5	85-100	75-100	65-100	50-80	25-40	10-25
	30-38	Loam, sandy loam	CL-ML, CL, SM-SC, SC	A-2, A-4	0-15	85-95	80-95	60-95	30-70	<25	4-10
	38-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Fu---------------- Fordum	0-8	Loam--------------	ML	A-4	0-10	85-100	65-100	60-100	50-90	15-35	NP-9
	8-30	Loam, fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0-10	85-100	65-100	50-85	30-60	<25	NP-5
	30-60	Sand, fine sand, loamy sand.	SP, SP-SM, SM	A-3, A-2, A-1	0-10	85-100	65-100	40-80	2-30	<25	NP
Fx. Fluvents											
IsA--------------- Iosco	0-8	Loamy sand--------	SM	A-2-4	0	95-100	95-100	50-70	15-30	---	NP
	8-24	Loamy sand, sand	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<20	NP-4
	24-60	Silty clay loam, clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	65-95	20-40	5-25
KaB, KaC, KaD, KaE-------------- Kennan	0-16	Bouldery fine sandy loam.	SM-SC, SM	A-2, A-4, A-1	25-50	75-100	75-100	45-90	20-50	<20	2-7
	16-37	Loam, sandy loam, silt loam.	SC, ML, CL, SM	A-2, A-4, A-1, A-6	0-25	75-100	75-100	45-100	20-90	<30	3-11
	37-60	Loamy sand, sandy loam, gravelly loamy sand.	SM, SP-SM, SM-SC	A-2, A-1-B	0-25	70-95	70-95	45-70	10-35	<20	NP-7
LvB, LvC---------- Lorenzo Variant	0-7	Sandy loam--------	SM	A-2	0	80-95	80-95	55-65	25-35	<21	1-4
	7-11	Sandy loam, loam	SM, SC, ML, CL	A-2, A-4	0	80-95	80-95	85-90	25-75	17-28	1-9
	11-16	Gravelly sandy loam, sandy loam, loamy sand.	GM, SM	A-1, A-2	0-10	45-80	35-75	15-60	15-35	<21	1-4
	16-60	Stratified sand to gravel.	GP, GP-GM, SP, SP-SM	A-1	0-10	40-75	35-70	15-50	0-10	---	NP
Lx---------------- Loxley	0-13	Hemic material---	Pt	A-8	---	---	---	---	---	---	---
	13-60	Sapric material	Pt	A-8	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
MaA*, MaB*, MaC*, MaD*:											
Mahtomedi------	0-15	Loamy sand-------	SM, SM-SC	A-2, A-1	0-1	95-100	60-90	40-70	15-30	<20	NP-4
	15-33	Sand, gravelly loamy sand, gravelly sand.	SP-SM, SM, SM-SC	A-2, A-3, A-1	0-15	70-95	50-90	30-70	5-30	<20	NP-4
	33-60	Sand, coarse sand, gravelly sand.	SP, SM, SP-SM	A-2, A-3, A-1	0-5	75-95	50-90	30-70	2-15	<20	NP
Menahga---------	0-10	Loamy sand-------	SM, SP-SM	A-2	0	95-100	85-100	60-80	10-30	---	NP
	10-60	Coarse sand, sand	SP, SP-SM	A-3, A-2	0	95-100	85-100	50-75	0-10	---	NP
McA--------------- Manawa	0-9	Silt loam---------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	7-15
	9-32	Silty clay, silty clay loam, clay.	CH, CL	A-7	0-5	85-100	80-100	80-100	65-95	45-80	25-50
	32-60	Silty clay, silty clay loam, clay loam.	CH, CL	A-6, A-7	0-5	85-100	80-100	80-100	65-95	30-80	15-50
Mk*:											
Markey-----------	0-28	Sapric material	Pt	A-8	---	---	---	---	---	---	---
	28-60	Sand, loamy sand	SP, SM, SP-SM	A-2, A-3	0	100	90-100	60-75	0-20	---	NP
Cathro-----------	0-26	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	26-60	Sandy loam, loam, silt loam.	SM, ML, SC, CL	A-4	0	100	95-100	60-100	35-90	15-26	3-10
MnA, MnB, MnC, MnD-------------- Menahga	0-10	Loamy sand-------	SM, SP-SM	A-2	0	95-100	85-100	60-80	10-30	---	NP
	10-60	Coarse sand, sand	SP, SP-SM	A-3, A-2	0	95-100	85-100	50-75	0-10	---	NP
MsB, MsC, MsD---- Menominee	0-13	Loamy sand-------	SM	A-2, A-4	0	100	100	50-80	15-40	---	NP
	13-26	Fine sand, very fine sand, sand.	SM, ML, SP-SM	A-2, A-4, A-3	0	100	100	50-80	5-55	---	NP
	26-46	Clay loam, loam, sandy clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	80-100	35-80	20-30	5-15
	46-60	Sandy loam, loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-2	0	95-100	95-100	60-95	30-75	15-30	5-12
Mu---------------- Minocqua	0-5	Silt loam---------	CL, CL-ML	A-4	0-8	80-100	75-100	60-100	45-90	20-30	5-10
	5-30	Silt loam, loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-2, A-4	0-8	80-100	75-100	45-100	25-90	21-26	4-8
	30-34	Loam, gravelly loamy sand, gravelly sandy loam.	SM, GM	A-2	0-8	50-100	45-100	5-75	2-40	<20	NP-4
	34-60	Sand, gravelly loamy sand, loamy sand.	SP, SP-SM, GP, GP-GM	A-1	0-8	35-100	30-100	5-75	0-30	---	NP
ObA--------------- Oesterle	0-9	Loam-------------	CL-ML, SM-SC	A-4	0-7	95-100	75-95	60-90	45-70	20-25	4-7
	9-23	Sandy loam, loam	CL-ML, CL, SM-SC, SC	A-2, A-4	0-7	90-100	70-95	40-90	20-70	20-30	4-10
	23-27	Sandy loam, loamy sand, gravelly loamy sand.	SM, SM-SC, SP-SM	A-2, A-1	0-7	90-100	50-90	25-75	10-35	<20	NP-6
	27-60	Gravelly sand, sand, loamy sand.	SW, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-7	60-90	40-85	20-60	0-10	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
OeB, OeC2, OeD2, OeE-------------- Onaway	0-15	Fine sandy loam	SM, SM-SC, SC	A-2, A-4	0-5	90-100	85-95	55-80	25-50	<20	NP-10
	15-28	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
	28-60	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
OfB, OfC2--------- Onaway	0-7	Fine sandy loam	ML, CL-ML, CL	A-4	0	90-100	90-100	75-90	60-70	<25	NP-10
	7-13	Fine sandy loam, loam.	SM, SM-SC, SC	A-2, A-4	0	90-100	85-95	55-70	25-40	<20	NP-10
	13-26	Clay loam, loam	CL, SC	A-4, A-6, A-7	0-15	90-100	90-100	85-95	40-80	25-42	7-22
	26-60	Cobbly sandy loam	CL-ML, CL, SC, SM-SC	A-2, A-4	25-50	90-100	80-95	60-95	30-70	<25	4-10
Pt*. Pits											
PvA--------------- Plover	0-8	Loam--------------	ML, CL, CL-ML	A-4	0	100	100	85-100	60-80	20-30	3-10
	8-26	Fine sandy loam, loamy fine sand, very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	100	50-100	15-90	<20	1-5
	26-36	Fine sandy loam, sandy loam, loamy sand.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	100	100	60-95	30-70	<25	2-7
	36-60	Stratified silt to very fine sand.	SM, ML, CL-ML, SM-SC	A-4	0	100	100	65-100	40-70	<25	2-7
RmD*: Rock outcrop.											
Rosholt Variant-	0-4	Silt loam---------	ML, CL-ML, CL	A-4	0-15	95-100	90-100	90-100	60-85	20-30	3-10
	4-22	Silt loam---------	ML, CL-ML	A-4	0-15	95-100	90-100	90-100	60-85	<20	1-5
	22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RoA, RoB, RoC, RoD-------------- Rosholt	0-8	Fine sandy loam	SM, SM-SC	A-2, A-1, A-4	0	75-100	70-100	45-70	20-40	<25	NP-4
	8-20	Loam, silt loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4, A-1	0	75-100	70-100	35-95	12-90	<25	NP-6
	20-28	Sandy loam, loam, silt loam.	SM-SC, SM, CL-ML, ML	A-2, A-4, A-1	0-5	75-100	70-100	45-95	20-90	<25	NP-6
	28-34	Gravelly loamy sand, loamy sand, sandy loam.	SM, GM, SP-SM, GP-GM	A-1, A-2	0-10	50-100	45-100	25-75	10-40	<25	NP-4
	34-60	Stratified sand to gravel.	GP, SP, SP-SM, GP-GM	A-1, A-2, A-3	0-25	20-100	20-100	10-65	0-10	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
RpB*, RpC*:											
Rosholt---------	0-8	Sandy loam-------	SM, SM-SC	A-2, A-1, A-4	0	75-100	70-100	45-70	20-40	<25	NP-4
	8-20	Loam, silt loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4, A-1	0	75-100	70-100	35-95	12-90	<25	NP-6
	20-28	Sandy loam, loam, silt loam.	SM-SC, SM, CL-ML, ML	A-2, A-4, A-1	0-5	75-100	70-100	45-95	20-90	<25	NP-6
	28-34	Gravelly loamy sand, loamy sand, sandy loam.	SM, GM, SP-SM, GP-GM	A-1, A-2	0-10	50-100	45-100	25-75	10-40	<25	NP-4
	34-60	Stratified sand to gravel.	GP, SP, SP-SM, GP-GM	A-1, A-2, A-3	0-25	20-100	20-100	10-65	0-10	---	NP
Elderon---------	0-7	Gravelly sandy loam.	SM, SP-SM, GM, GP-GM	A-1, A-2, A-4	5-25	30-95	30-95	20-70	10-40	<20	NP-4
	7-15	Very cobbly coarse sandy loam, very cobbly loamy coarse sand.	SM, SP-SM, GM, GP-GM	A-1	5-25	30-70	30-70	15-50	5-25	<25	NP-4
	15-44	Very cobbly loamy coarse sand, gravelly coarse sand, very cobbly sand.	SM, SP, GM, GP	A-1	5-25	30-70	30-70	10-50	1-25	---	NP
	44-60	Very cobbly coarse sand, cobbly coarse sand, gravelly sand.	SM, SP, GM, GP	A-1	5-25	30-70	25-70	10-50	1-20	---	NP
RrD*:											
Rosholt---------	0-8	Fine sandy loam	SM, SM-SC	A-2, A-1, A-4	0	75-100	70-100	45-70	20-40	<25	NP-4
	8-20	Loam, silt loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4, A-1	0	75-100	70-100	35-95	12-90	<25	NP-6
	20-28	Sandy loam, loam, silt loam.	SM-SC, SM, CL-ML, ML	A-2, A-4, A-1	0-5	75-100	70-100	45-95	20-90	<25	NP-6
	28-34	Gravelly loamy sand, loamy sand, sandy loam.	SM, GM, SP-SM, GP-GM	A-1, A-2	0-10	50-100	45-100	25-75	10-40	<25	NP-4
	34-60	Stratified sand to gravel.	GP, SP, SP-SM, GP-GM	A-1, A-2, A-3	0-25	20-100	20-100	10-65	0-10	---	NP
Rock outcrop.											
RsA, RsB--------- Rousseau	0-12	Loamy fine sand	SM	A-2-4, A-4	0	100	100	75-95	25-45	---	NP
	12-33	Fine sand--------	SP-SM, SM	A-3, A-2-4	0	100	100	90-100	5-25	---	NP
	33-60	Fine sand, sand	SP, SP-SM	A-3	0	100	100	85-100	0-10	---	NP
RuB, RuC, RuD---- Rubicon	0-4	Sand-------------	SM, SP-SM	A-2, A-3	0	95-100	90-100	50-70	5-15	---	NP
	4-17	Sand-------------	SM, SP-SM	A-2, A-3	0	95-100	90-100	50-75	5-15	---	NP
	17-60	Sand-------------	SP, SP-SM	A-1, A-2, A-3	0	95-100	90-100	40-65	0-10	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
SaA, SaB, SaC---- Salter Variant	0-8	Very fine sandy loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	100	75-95	45-60	10-19	2-7
	8-31	Very fine sandy loam, loam, silt loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-90	<30	3-10
	31-66	Stratified silt to very fine sand.	ML, CL, SM, SC	A-4	0	100	95-100	80-100	40-95	<25	NP-8
Sb*. Saprists											
ScA-------------- Scott Lake	0-15	Loam------------	ML, CL-ML, SM, SM-SC	A-4	0-7	85-100	75-100	65-100	45-90	<25	3-7
	15-28	Loam, silt loam, sandy loam.	SC, CL, SM-SC, CL-ML	A-2, A-4	0-7	85-100	85-100	50-100	25-90	20-30	5-10
	28-31	Sandy loam, gravelly sandy loam, loamy coarse sand.	SM, SW-SM, SP-SM	A-1, A-2, A-3, A-4	0-35	70-95	50-95	20-70	7-50	<25	NP
	31-60	Gravelly loamy sand, gravelly coarse sand, very gravelly sand.	SW, SM, GP, GM	A-1, A-2, A-3	0-40	30-85	30-85	20-70	3-25	---	NP
Sd--------------- Seelyeville	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
SfB, SfC, SfD---- Shawano	0-8	Loamy fine sand	SM	A-2, A-4	0	95-100	95-100	75-100	30-40	---	NP
	8-34	Fine sand--------	SM	A-2	0	95-100	95-100	65-100	20-35	---	NP
	34-60	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
SgB*, SgC*: Shawano----------	0-8	Loamy fine sand	SM	A-2, A-4	0	95-100	95-100	75-100	30-40	---	NP
	8-34	Fine sand--------	SM	A-2	0	95-100	95-100	65-100	20-35	---	NP
	34-60	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
Briggsville------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-40	5-15
	8-28	Silty clay, silty clay loam.	CH, CL	A-6, A-7	0	100	100	95-100	95-100	35-65	15-40
	28-60	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	90-100	30-60	10-35
ShA-------------- Shiocton	0-10	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	85-100	60-95	20-30	3-10
	10-26	Silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	65-95	<30	NP-10
	26-60	Stratified silt to very fine sand.	ML, CL	A-4	0	100	95-100	80-100	65-95	<25	NP-8
SkA-------------- Shiocton Variant	0-8	Silt loam--------	ML, CL-ML, CL	A-4	0	100	100	85-100	60-90	<28	NP-9
	8-22	Silt loam, very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	100	100	70-100	50-90	<28	NP-9
	22-60	Cobbly silt loam, cobbly loam, cobbly sandy loam.	ML, CL, SM, SC	A-2, A-4	25-50	95-100	95-100	60-95	30-80	19-28	2-9

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	
SoA-------------- Solona	0-9	Loam-------------	ML, CL, CL-ML	A-4	0-3	80-100	75-100	65-100	50-90	20-30	3-10
	9-27	Loam, sandy loam, fine sandy loam.	CL, ML, SC, SM	A-2, A-4	0-3	80-100	75-100	45-100	25-80	20-30	3-10
	27-60	Loam, sandy loam, gravelly sandy loam.	ML, CL, SM, SC	A-2, A-4, A-1	0-5	75-100	60-100	40-90	20-70	<25	NP-10
SyB*:											
Solona----------	0-9	Loam-------------	ML, CL, CL-ML	A-4	0-3	80-100	75-100	65-100	50-90	20-30	3-10
	9-27	Loam, sandy loam, fine sandy loam.	CL, ML, SC, SM	A-2, A-4	0-3	80-100	75-100	45-100	25-80	20-30	3-10
	27-60	Loam, sandy loam, gravelly sandy loam.	ML, CL, SM, SC	A-2, A-4, A-1	0-5	75-100	60-100	40-90	20-70	<25	NP-10
Onaway----------	0-15	Loam-------------	ML, CL-ML, CL	A-4	0-5	90-100	90-100	75-90	60-70	<25	NP-10
	15-28	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
	28-60	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
TlB, TlC2, TlD--- Tilleda	0-12	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
	12-30	Loam, sandy clay loam, clay loam.	CL, SC	A-4, A-2, A-6, A-7	0-8	95-100	85-100	70-100	30-70	25-47	9-27
	30-34	Loam, clay loam	CL	A-4, A-6, A-7	0-8	95-100	85-100	75-100	50-80	25-46	7-27
	34-60	Loam, clay loam, gravelly sandy loam.	CL, SC	A-4, A-6, A-7	0-8	95-100	60-100	50-95	40-80	25-46	7-27
TvB, TvC2-------- Tilleda Variant	0-9	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0-8	95-100	85-100	65-85	35-55	20-25	3-7
	9-25	Loam, clay loam, sandy clay loam.	CL, SC	A-2, A-4, A-6	0-8	95-100	85-100	75-100	30-80	28-43	9-21
	25-36	Fine sandy loam, loam, loamy sand.	SM, SC, ML, CL	A-4, A-2, A-1	0-8	95-100	85-100	45-95	12-75	<30	NP-10
	36-60	Fine sand, sand, sand and gravel.	SP, SP-SM, SM	A-2, A-3, A-1	0-5	45-100	40-100	15-80	1-35	---	NP
WaA-------------- Wainola	0-5	Fine sand--------	SM	A-2-4	0	100	95-100	65-80	20-35	---	NP
	5-22	Fine sand, loamy fine sand.	SM	A-2-4	0	100	95-100	50-80	15-35	---	NP
	22-60	Fine sand, loamy fine sand, very fine sand.	SM	A-2-4	0	100	95-100	50-80	15-35	---	NP
Wh--------------- Wheatley	0-9	Loamy fine sand	SM, SP-SM	A-2-4, A-1-B	0-5	85-95	80-95	45-75	10-30	---	NP
	9-28	Fine sand, gravelly loamy sand, loamy fine sand.	SM, SP-SM	A-2-4, A-1-B	0-5	85-95	80-90	40-60	10-20	---	NP
	28-60	Stratified gravel to sand.	GW, SW, GP, SP	A-1	5-10	20-80	20-80	20-40	0-5	---	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	Reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
AfB---------------- Alban	0-7	3-8	1.35-1.65	0.6-2.0	0.13-0.18	5.1-7.3	Low-----------	0.24	5	3	.5-2
	7-38	8-15	1.55-1.65	0.6-2.0	0.12-0.20	5.1-7.3	Low-----------	0.24			
	38-60	1-12	1.50-1.70	0.6-2.0	0.05-0.22	5.1-7.3	Low-----------	0.24			
AgB---------------- Alban Variant	0-9	2-4	1.35-1.65	2.0-6.0	0.10-0.12	5.6-6.0	Low-----------	0.17	5	2	1-2
	9-22	2-4	1.45-1.65	6.0-20	0.06-0.11	5.6-6.0	Low-----------	0.17			
	22-25	10-15	1.40-1.70	0.6-2.0	0.12-0.19	4.5-5.0	Low-----------	0.24			
	25-44	5-10	1.35-1.85	0.6-2.0	0.05-0.22	5.1-5.5	Low-----------	0.43			
	44-60	2-4	1.55-1.70	2.0-20	0.05-0.10	5.1-6.5	Low-----------	0.15			
Ah----------------- Angelica	0-9	10-20	1.12-1.59	0.6-2.0	0.18-0.22	6.1-7.3	Low-----------	0.32	5	5	4-10
	9-23	18-35	1.48-1.80	0.2-0.6	0.10-0.20	6.1-7.8	Moderate-----	0.32			
	23-60	5-20	1.46-1.95	0.2-0.6	0.10-0.20	7.4-8.4	Low-----------	0.32			
AtB---------------- Antigo	0-8	8-15	1.35-1.55	0.6-2.0	0.22-0.28	4.5-6.5	Low-----------	0.37	4	5	2-4
	8-14	8-13	1.40-1.50	0.6-2.0	0.20-0.26	4.5-6.5	Low-----------	0.37			
	14-33	18-30	1.55-1.65	0.6-2.0	0.18-0.22	4.5-6.5	Moderate-----	0.37			
	33-37	2-15	1.55-1.85	0.6-2.0	0.08-0.19	4.5-6.5	Low-----------	0.37			
	37-60	1-6	1.75-2.20	>6.0	0.02-0.06	5.1-6.5	Low-----------	0.10			
AuA---------------- Au Gres	0-8	10-15	0.65-1.55	6.0-20	0.07-0.09	4.5-7.3	Low-----------	0.15	5	2	2-4
	8-37	1-15	1.20-1.55	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.15			
	37-60	0-8	1.20-1.65	6.0-20	0.05-0.07	5.1-6.0	Low-----------	0.15			
AxA---------------- Au Gres Variant	0-9	3-8	1.35-1.65	2.0-6.0	0.10-0.12	6.1-7.8	Low-----------	0.17	4	2	1-3
	9-14	1-5	1.35-1.65	6.0-20	0.06-0.08	6.1-7.8	Low-----------	0.17			
	14-28	1-8	1.45-1.65	6.0-20	0.06-0.10	6.1-7.8	Low-----------	0.17			
	28-60	0-5	1.30-2.00	>20	0.03-0.05	7.4-8.4	Low-----------	0.10			
Ba----------------- Bach	0-8	2-15	1.12-1.59	2.0-6.0	0.20-0.24	6.6-8.4	Low-----------	0.28	5	5	4-10
	8-60	0-18	1.48-1.95	0.6-2.0	0.14-0.22	7.4-8.4	Low-----------	0.28			
BrB---------------- Boyer	0-7	5-15	1.15-1.60	2.0-6.0	0.10-0.15	5.6-7.3	Low-----------	0.24	4-3	3	1-3
	7-28	10-18	1.25-1.60	2.0-6.0	0.12-0.18	5.6-7.8	Low-----------	0.24			
	28-60	0-10	1.20-1.45	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
Bs----------------- Brevort	0-8	3-15	1.35-1.50	6.0-20	0.10-0.20	5.6-7.8	Low-----------	0.17	5	2	4-16
	8-21	2-15	1.40-1.55	6.0-20	0.06-0.11	5.6-7.8	Low-----------	0.17			
	21-60	0-35	1.46-1.95	0.2-0.6	0.14-0.22	7.4-8.4	Moderate-----	0.43			
BtA, BtB---------- Briggsville	0-8	14-25	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.37	5	5	1-2
	8-28	35-50	1.60-1.80	0.2-0.6	0.11-0.20	5.1-8.4	Moderate-----	0.37			
	28-60	35-50	1.65-1.85	0.2-0.6	0.08-0.20	7.4-8.4	Moderate-----	0.37			
BuA---------------- Brill	0-7	8-15	1.25-1.35	0.6-2.0	0.22-0.28	4.5-6.5	Low-----------	0.37	4	5	2-4
	7-12	8-13	1.40-1.50	0.6-2.0	0.20-0.26	4.5-6.5	Low-----------	0.37			
	12-34	18-30	1.45-1.55	0.6-2.0	0.18-0.22	4.5-6.5	Moderate-----	0.37			
	34-38	2-15	1.45-1.75	0.6-6.0	0.10-0.22	4.5-6.5	Low-----------	0.37			
	38-60	1-6	1.75-2.00	>6.0	0.02-0.04	5.1-7.3	Low-----------	0.10			
Co----------------- Cormant	0-8	3-10	1.30-1.50	6.0-20	0.08-0.12	6.1-7.3	Low-----------	0.17	5	2	4-16
	8-60	0-5	1.50-1.70	6.0-20	0.06-0.10	6.1-7.8	Low-----------	0.17			
CrB, CrC, CrD----- Cromwell	0-17	5-18	1.20-1.40	0.6-2.0	0.16-0.18	4.5-6.0	Low-----------	0.20	3	3	1-4
	17-60	2-8	1.35-1.60	6.0-20	0.05-0.07	5.1-6.5	Low-----------	0.15			
CtA---------------- Croswell	0-22	10-15	1.25-1.50	6.0-20	0.10-0.12	4.5-6.0	Low-----------	0.15	5	2	<1
	22-36	0-10	1.25-1.60	6.0-20	0.06-0.08	5.1-6.5	Low-----------	0.15			
	36-60	0-10	1.25-1.60	6.0-20	0.05-0.07	5.6-7.3	Low-----------	0.15			
Dp*. Dumps											

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	Reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
EcD*, EcE*:											
Elderon----------	0-7	4-10	1.40-1.70	2.0-6.0	0.05-0.14	5.1-7.3	Low-----------	0.17	3	8	1-3
	7-15	2-10	1.60-1.70	6.0-20	0.03-0.12	5.1-7.3	Low-----------	0.10			
	15-44	2-8	1.60-1.70	6.0-20	0.01-0.05	5.1-7.3	Low-----------	0.10			
	44-60	1-6	1.55-1.70	>20	0.01-0.05	6.6-7.8	Low-----------	0.10			
Rosholt----------	0-8	4-10	1.50-1.60	0.6-6.0	0.09-0.15	5.1-7.3	Low-----------	0.24	4	3	1-3
	8-13	4-12	1.70-1.80	2.0-6.0	0.08-0.19	5.1-7.3	Low-----------	0.24			
	13-28	6-18	1.65-1.75	2.0-6.0	0.06-0.14	5.1-7.3	Low-----------	0.24			
	28-34	4-10	1.55-1.65	6.0-20	0.04-0.12	5.1-7.3	Low-----------	0.10			
	34-60	0-2	1.55-2.20	>20	0.02-0.04	5.1-6.5	Low-----------	0.10			
FpB, FpC---------- Fairport	0-11	10-20	1.30-1.70	0.6-2.0	0.13-0.18	5.6-7.8	Low-----------	0.28	4	3	1-3
	11-30	18-35	1.35-1.80	0.6-2.0	0.12-0.20	7.4-8.4	Moderate-----	0.37			
	30-38	5-25	1.35-1.80	0.6-2.0	0.10-0.20	7.4-8.4	Low-----------	0.37			
	38-60	---	---	---	---	---	-------------	----			
Fu---------------- Fordum	0-8	13-23	1.35-1.45	0.6-2.0	0.20-0.24	5.6-8.4	Low-----------	0.28	5	5	---
	8-30	2-18	1.40-1.50	0.6-6.0	0.13-0.16	5.6-8.4	Low-----------	0.28			
	30-60	2-5	1.55-1.65	>6.0	0.06-0.09	5.6-8.4	Low-----------	0.15			
Fx. Fluvents											
IsA--------------- Iosco	0-8	10-15	1.25-1.41	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.17	5	2	2-4
	8-24	0-15	1.35-1.45	6.0-20	0.06-0.11	5.1-6.5	Low-----------	0.17			
	24-60	18-35	1.47-1.90	0.2-0.6	0.14-0.20	6.1-7.8	Moderate-----	0.37			
KaB, KaC, KaD, KaE-------------- Kennan	0-16	5-18	1.20-1.60	0.6-2.0	0.06-0.13	4.5-7.3	Low-----------	0.17	5	8	---
	16-37	5-18	1.60-1.70	0.6-2.0	0.08-0.22	4.5-7.3	Low-----------	0.28			
	37-60	5-10	1.65-1.85	0.6-6.0	0.05-0.13	4.5-7.3	Low-----------	0.28			
LvB, LvC---------- Lorenzo Variant	0-7	5-10	1.35-1.65	0.6-2.0	0.13-0.15	6.1-7.8	Low-----------	0.20	3	3	1-3
	7-11	3-18	1.40-1.65	0.6-2.0	0.13-0.22	6.1-7.8	Low-----------	0.20			
	11-16	5-10	1.40-1.70	0.6-6.0	0.09-0.14	6.1-7.8	Low-----------	0.20			
	16-60	0-5	1.30-2.20	>20	0.02-0.05	7.4-8.4	Low-----------	0.10			
Lx---------------- Loxley	0-13	---	0.30-0.40	2.0-6.0	0.45-0.55	<5.6	-------------	----	---	3	---
	13-60	---	0.10-0.35	2.0-6.0	0.35-0.45	<5.6	-------------	----			
MaA*, MaB*, MaC*, MaD*:											
Mahtomedi-------	0-15	2-15	1.40-1.60	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.15	5	2	<1
	15-33	0-10	1.45-1.70	6.0-20	0.05-0.07	5.1-6.5	Low-----------	0.10			
	33-60	0-10	1.45-1.75	6.0-20	0.04-0.09	5.1-7.8	Low-----------	0.10			
Menahga---------	0-10	2-10	1.20-1.50	6.0-20	0.10-0.12	4.5-6.0	Low-----------	0.15	5	2	<1
	10-60	0-5	1.50-1.65	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
McA--------------- Manawa	0-9	13-27	1.30-1.45	0.6-2.0	0.22-0.24	6.1-7.8	Low-----------	0.37	3	5	4-9
	9-32	45-55	1.65-1.85	0.06-0.2	0.09-0.20	5.6-8.4	Moderate-----	0.37			
	32-60	35-60	1.85-1.95	0.06-0.2	0.08-0.20	7.4-8.4	Moderate-----	0.37			
Mk*:											
Markey-----------	0-28	---	0.15-0.45	2.0-6.0	0.35-0.45	5.6-7.8	-------------	----	---	3	>20
	28-60	0-10	1.40-1.65	6.0-20	0.03-0.08	6.1-8.4	Low-----------	----			
Cathro-----------	0-26	---	0.28-0.45	2.0-6.0	0.45-0.55	5.6-7.8	-------------	----	---	3	>20
	26-60	0-25	1.50-2.00	0.2-2.0	0.11-0.22	6.6-8.4	Low-----------	----			
MnA, MnB, MnC, MnD-------------- Menahga	0-10	2-10	1.20-1.50	6.0-20	0.10-0.12	4.5-6.0	Low-----------	0.15	5	2	<1
	10-60	0-5	1.50-1.65	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			

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	Reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
MsB, MsC, MsD---- Menominee	0-13	3-7	1.15-1.60	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.17	5	2	.5-1
	13-26	2-5	1.25-1.60	6.0-20	0.06-0.08	5.1-6.5	Low-----------	0.17			
	26-46	18-35	1.30-1.70	0.6-2.0	0.15-0.20	5.6-8.4	Moderate-----	0.32			
	46-60	10-20	1.30-1.70	0.6-2.0	0.11-0.19	5.6-8.4	Low-----------	0.32			
Mu--------------- Minocqua	0-5	8-12	1.20-1.55	0.6-2.0	0.19-0.24	5.1-7.8	Low-----------	0.37	4	5	4-10
	5-30	10-15	1.35-1.45	0.6-2.0	0.11-0.19	5.1-7.8	Low-----------	0.37			
	30-34	3-10	1.65-1.75	2.0-6.0	0.06-0.13	5.1-7.8	Low-----------	0.10			
	34-60	0-2	1.30-2.20	>6.0	0.02-0.04	5.1-7.8	Low-----------	0.10			
ObA-------------- Oesterle	0-9	10-15	1.35-1.55	0.6-2.0	0.16-0.22	4.5-6.5	Low-----------	0.32	4	5	2-3
	9-23	10-18	1.55-1.65	0.6-2.0	0.09-0.19	4.5-6.5	Low-----------	0.24			
	23-27	6-12	1.55-1.70	0.6-6.0	0.06-0.13	4.5-6.5	Low-----------	0.24			
	27-60	1-6	1.55-1.70	6.0-20	0.02-0.04	5.1-6.5	Low-----------	0.10			
OeB, OeC2, OeD2, OeE------------- Onaway	0-15	10-20	1.30-1.70	2.0-6.0	0.08-0.16	5.6-7.8	Low-----------	0.24	5	3	1-3
	15-28	18-35	1.30-1.85	0.6-2.0	0.12-0.18	5.6-7.8	Moderate-----	0.32			
	28-60	5-25	1.30-1.70	0.6-2.0	0.10-0.20	7.4-8.4	Low-----------	0.32			
OfB, OfC2-------- Onaway	0-7	7-12	1.35-1.55	0.6-2.0	0.20-0.22	6.6-7.3	Low-----------	0.32	3	3	1-3
	7-13	5-12	1.35-1.70	2.0-6.0	0.13-0.15	6.6-7.3	Low-----------	0.32			
	13-26	18-35	1.55-1.65	0.6-2.0	0.14-0.19	6.6-7.8	Moderate-----	0.32			
	26-60	5-25	1.35-1.70	0.6-2.0	0.10-0.19	7.4-8.4	Low-----------	0.24			
Pt*. Pits											
PvA-------------- Plover	0-8	5-12	1.35-1.65	0.6-2.0	0.20-0.24	4.5-6.0	Low-----------	0.37	5	5	2-4
	8-26	5-18	1.40-1.70	0.6-2.0	0.09-0.22	4.5-6.0	Low-----------	0.24			
	26-36	10-18	1.50-1.70	0.6-2.0	0.12-0.17	4.5-6.0	Low-----------	0.24			
	36-60	1-12	1.50-1.70	0.6-2.0	0.11-0.22	5.6-7.3	Low-----------	0.24			
RmD*: Rock outcrop.											
Rosholt Variant-	0-4	10-15	1.35-1.55	0.6-2.0	0.22-0.24	4.5-6.5	Low-----------	0.37	3	5	---
	4-22	10-15	1.55-1.65	0.6-2.0	0.20-0.22	4.5-6.5	Low-----------	0.37			
	22	---	---	---	---	---	-------------	----			
RoA, RoB, RoC, RoD------------- Rosholt	0-8	4-10	1.50-1.60	0.6-6.0	0.09-0.15	5.1-7.3	Low-----------	0.24	4	3	1-3
	8-20	4-12	1.70-1.80	2.0-6.0	0.08-0.19	5.1-7.3	Low-----------	0.24			
	20-28	6-18	1.65-1.75	2.0-6.0	0.06-0.14	5.1-7.3	Low-----------	0.24			
	28-34	4-10	1.55-1.65	6.0-20	0.04-0.12	5.1-7.3	Low-----------	0.10			
	34-60	0-2	1.55-2.20	>20	0.02-0.04	5.1-6.5	Low-----------	0.10			
RpB*, RpC*: Rosholt---------	0-8	4-10	1.50-1.60	0.6-6.0	0.09-0.15	5.1-7.3	Low-----------	0.24	4	3	1-3
	8-20	4-12	1.70-1.80	2.0-6.0	0.08-0.19	5.1-7.3	Low-----------	0.24			
	20-28	6-18	1.65-1.75	2.0-6.0	0.06-0.14	5.1-7.3	Low-----------	0.24			
	28-34	4-10	1.55-1.65	6.0-20	0.04-0.12	5.1-7.3	Low-----------	0.10			
	34-60	0-2	1.55-2.20	>20	0.02-0.04	5.1-6.5	Low-----------	0.10			
Elderon---------	0-7	4-10	1.40-1.70	2.0-6.0	0.05-0.14	5.1-7.3	Low-----------	0.17	3	8	1-3
	7-15	2-10	1.60-1.70	2.0-6.0	0.03-0.12	5.1-7.3	Low-----------	0.10			
	15-44	2-8	1.60-1.70	2.0-6.0	0.01-0.05	5.1-7.3	Low-----------	0.10			
	44-60	1-6	1.55-1.70	>20	0.01-0.05	6.6-7.8	Low-----------	0.10			
RrD*: Rosholt---------	0-8	4-10	1.50-1.60	0.6-6.0	0.09-0.15	5.1-7.3	Low-----------	0.24	4	3	1-3
	8-20	4-12	1.70-1.80	2.0-6.0	0.08-0.19	5.1-7.3	Low-----------	0.24			
	20-28	6-18	1.65-1.75	2.0-6.0	0.06-0.14	5.1-7.3	Low-----------	0.24			
	28-34	4-10	1.55-1.65	6.0-20	0.04-0.12	5.1-7.3	Low-----------	0.10			
	34-60	0-2	1.55-2.20	>20	0.02-0.04	5.1-6.5	Low-----------	0.10			
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	Reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
RsA, RsB--------- Rousseau	0-12	2-12	1.27-1.56	2.0-6.0	0.10-0.12	5.1-6.0	Low-----------	0.15	5	2	<1
	12-33	0-10	1.26-1.60	6.0-20	0.06-0.08	4.5-6.0	Low-----------	0.15			
	33-60	0-10	1.48-1.67	6.0-20	0.05-0.07	5.6-6.5	Low-----------	0.15			
RuB, RuC, RuD---- Rubicon	0-4	0-5	1.36-1.41	6.0-20	0.05-0.09	4.5-6.0	Low-----------	0.15	5	1	---
	4-17	0-10	1.30-1.60	6.0-20	0.04-0.08	4.5-6.0	Low-----------	0.15			
	17-60	0-5	1.40-1.55	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
SaA, SaB, SaC---- Salter Variant	0-8	2-15	1.20-1.70	0.6-2.0	0.20-0.22	6.6-7.8	Low-----------	0.37	5	3	1-2
	8-31	5-18	1.45-1.65	0.6-2.0	0.17-0.22	6.6-7.8	Low-----------	0.37			
	31-66	3-18	1.65-1.80	0.6-2.0	0.08-0.13	7.4-8.4	Low-----------	0.37			
Sb*. Saprists											
ScA-------------- Scott Lake	0-15	10-15	1.35-1.50	0.6-2.0	0.17-0.24	4.5-6.5	Low-----------	0.37	4	5	2-3
	15-28	8-18	1.55-1.70	0.6-2.0	0.12-0.22	4.5-6.5	Low-----------	0.37			
	28-31	5-12	1.55-1.80	0.6-2.0	0.04-0.14	4.5-6.5	Low-----------	0.10			
	31-60	1-6	1.75-2.00	>6.0	0.02-0.04	4.5-7.3	Low-----------	0.10			
Sd--------------- Seelyeville	0-60	---	0.10-0.25	2.0-6.0	0.35-0.45	5.6-7.3	-------------	----	---	3	>20
SfB, SfC, SfD---- Shawano	0-8	2-8	1.10-1.35	6.0-20	0.11-0.13	4.5-7.3	Low-----------	0.17	5	2	<1
	8-34	1-3	1.45-1.80	6.0-20	0.07-0.09	5.1-6.5	Low-----------	0.17			
	34-60	1-3	1.70-1.90	6.0-20	0.05-0.08	5.6-7.8	Low-----------	0.17			
SgB*, SgC*: Shawano----------	0-8	2-8	1.10-1.35	6.0-20	0.11-0.13	4.5-7.3	Low-----------	0.17	5	2	<1
	8-34	1-3	1.45-1.80	6.0-20	0.07-0.09	5.1-6.5	Low-----------	0.17			
	34-60	1-3	1.70-1.90	6.0-20	0.05-0.08	5.6-7.8	Low-----------	0.17			
Briggsville------	0-8	14-25	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.37	5	5	1-2
	8-28	35-50	1.60-1.80	0.2-0.6	0.11-0.20	5.1-8.4	Moderate------	0.37			
	28-60	35-50	1.65-1.85	0.2-0.6	0.08-0.20	7.4-8.4	Moderate------	0.37			
ShA-------------- Shiocton	0-10	5-20	1.35-1.55	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.32	5	5	2-4
	10-26	5-18	1.45-1.65	0.6-2.0	0.17-0.22	6.6-8.4	Low-----------	0.32			
	26-60	5-18	1.65-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low-----------	0.43			
SkA-------------- Shiocton Variant	0-8	3-18	1.35-1.55	0.6-2.0	0.20-0.24	6.6-7.8	Low-----------	0.32	4	5	2-4
	8-22	3-18	1.45-1.65	0.6-2.0	0.17-0.22	6.6-8.4	Low-----------	0.32			
	22-60	8-18	1.45-1.70	0.6-2.0	0.07-0.19	7.4-8.4	Low-----------	0.24			
SoA-------------- Solona	0-9	15-20	1.35-1.55	0.6-2.0	0.19-0.24	6.6-7.8	Low-----------	0.32	5	5	1-3
	9-27	12-18	1.45-1.65	0.6-2.0	0.11-0.22	6.6-7.8	Low-----------	0.32			
	27-60	5-20	1.65-2.00	0.6-2.0	0.09-0.19	7.4-8.4	Low-----------	0.32			
SyB*: Solona-----------	0-9	15-20	1.35-1.55	0.6-2.0	0.19-0.24	6.6-7.8	Low-----------	0.32	5	5	1-3
	9-27	12-18	1.45-1.65	0.6-2.0	0.11-0.22	6.6-7.8	Low-----------	0.32			
	27-60	5-20	1.65-2.00	0.6-2.0	0.09-0.19	7.4-8.4	Low-----------	0.32			
Onaway-----------	0-15	10-22	1.30-1.70	0.6-2.0	0.14-0.20	5.6-7.8	Low-----------	0.32	5	5	1-3
	15-28	18-35	1.30-1.85	0.2-0.6	0.12-0.18	5.6-7.8	Moderate------	0.32			
	28-60	5-25	1.35-1.70	0.2-0.6	0.10-0.20	7.4-8.4	Low-----------	0.32			
TlB, TlC2, TlD--- Tilleda	0-12	8-14	1.35-1.55	0.6-2.0	0.12-0.18	5.1-7.3	Low-----------	0.24	5	3	1-3
	12-30	18-30	1.55-1.65	0.6-2.0	0.13-0.18	5.1-7.3	Moderate------	0.24			
	30-34	18-30	1.55-1.65	0.6-2.0	0.13-0.19	5.1-7.8	Moderate------	0.24			
	34-60	15-30	1.65-1.80	0.6-2.0	0.12-0.18	5.1-7.8	Low-----------	0.24			

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	Reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
TvB, TvC2---------	0-9	8-14	1.35-1.55	0.6-2.0	0.16-0.18	5.1-7.3	Low-----------	0.24	4	3	1-3
Tilleda Variant	9-25	18-34	1.55-1.65	0.6-2.0	0.15-0.19	5.1-6.5	Moderate-----	0.32			
	25-36	5-20	1.40-1.60	0.6-2.0	0.15-0.17	5.1-6.5	Low-----------	0.24			
	36-60	0-10	1.30-1.70	6.0-20	0.02-0.07	5.6-7.3	Low-----------	0.15			
WaA---------------	0-5	0-10	1.35-1.50	6.0-20	0.07-0.09	5.1-6.5	Low-----------	0.15	5	1	2-4
Wainola	5-22	2-12	1.35-1.45	6.0-20	0.06-0.11	5.1-6.5	Low-----------	0.15			
	22-60	0-10	1.25-1.50	6.0-20	0.05-0.07	5.6-6.5	Low-----------	0.15			
Wh----------------	0-9	0-15	0.90-1.60	2.0-6.0	0.10-0.12	6.6-7.8	Low-----------	0.15	2	2	4-16
Wheatley	9-28	2-15	1.45-1.70	6.0-20	0.06-0.08	6.6-7.8	Low-----------	0.15			
	28-60	0-10	1.55-1.70	>20	0.02-0.04	7.4-8.4	Low-----------	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[See text for definition of terms. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Total subsi-dence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness			Uncoated steel	Concrete
					Ft			In		In			
AfB: Alban	B	None	---	---	3.0-6.0	Perched	Nov-Apr	>60	---	---	Moderate	Low	Moderate.
AgB: Alban Variant	B	None	---	---	3.0-6.0	Apparent	Nov-May	>60	---	---	Low	Low	High.
Ah: Angelica	B/D	None	---	---	+1-1.0	Apparent	Oct-Jun	>60	---	---	High	High	Low.
AtB: Antigo	B	None	---	---	>6.0	---	---	>60	---	---	High	Moderate	High.
AuA: Au Gres	B	None	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	Moderate	Low	Moderate.
AxA: Au Gres Variant	B	Rare	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	Moderate	Low	Low.
Ba: Bach	B/D	None	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	---	High	High	Low.
BrB: Boyer	B	None	---	---	>6.0	---	---	>60	---	---	Low	Low	Moderate.
Bs: Brevort	B/D	None	---	---	+1-1.0	Apparent	Nov-May	>60	---	---	High	Low	Moderate.
BtA, BtB: Briggsville	C	None	---	---	>6.0	---	---	>60	---	---	Moderate	High	Moderate.
BuA: Brill	B	None	---	---	3.0-6.0	Apparent	Sep-May	>60	---	---	High	Moderate	Moderate.
Co: Cormant	A/D	Rare	---	---	+1-1.0	Apparent	Jan-Dec	>60	---	---	Moderate	High	Low.
CrB, CrC, CrD: Cromwell	A	None	---	---	>6.0	---	---	>60	---	---	Low	Low	Moderate.
CtA: Croswell	A	None	---	---	3.0-6.0	Apparent	Nov-Apr	>60	---	---	Low	Low	Moderate.
Dp*. Dumps													
EcD*, EcE*:													
Elderon	B	None	---	---	>6.0	---	---	>60	---	---	Low	Low	Moderate.
Rosholt	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Low	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Total subsi-dence	Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness			Uncoated steel	Concrete
					Ft			In		In			
FpB, FpC-------- Fairport	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Moderate	Low.
Fu-------------- Fordum	D	Frequent----	Long------	Mar-Jun	+1-1.0	Apparent	Jan-Dec	>60	---	---	High-----	High-----	High.
Fx. Fluvents													
IsA------------- Iosco	B	None--------	---	---	1.0-3.0	Apparent	Nov-Jun	>60	---	---	Moderate	Low------	Moderate.
KaB, KaC, KaD, KaE------------ Kennan	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	High.
LvB, LvC-------- Lorenzo Variant	B	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Low.
Lx-------------- Loxley	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	>60	---	50-55	High-----	High-----	High.
MaA*, MaB*, MaC*, MaD*: Mahtomedi-----	A	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	High.
Menahga-------	A	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Moderate.
McA------------- Manawa	C	Occasional	Brief-----	Nov-May	1.0-3.0	Perched	Nov-Jun	>60	---	---	High-----	High-----	Low.
Mk*: Markey---------	A/D	Frequent----	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	25-30	High-----	High-----	Low.
Cathro---------	A/D	None--------	---	---	+1-1.0	Apparent	Nov-Jun	>60	---	19-22	High-----	High-----	Low.
MnA, MnB, MnC, MnD------------ Menahga	A	None--------	---	---	>6.0	---	---	>60	---	---	Low------	Low------	Moderate.
MsB, MsC, MsD--- Menominee	A	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate	Moderate.
Mu-------------- Minocqua	B/D	Occasional	Brief-----	Nov-May	+1-1.0	Apparent	Nov-May	>60	---	---	High-----	High-----	High.
ObA------------- Oesterle	C	Rare--------	---	---	1.0-3.0	Apparent	Oct-May	>60	---	---	High-----	Low------	Moderate.
OeB, OeC2, OeD2, OeE------------ Onaway	D	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Total subsidence	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In		In			
OfB, OfC2-------Onaway	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	Moderate.
Pt*. Pits													
PvA-------------Plover	C	Rare---------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	High------	Moderate	High.
RmD*: Rock outcrop.													
Rosholt Variant	B	None---------	---	---	>6.0	---	---	20-40	Hard	---	Moderate	Low-------	Moderate.
RoA, RoB, RoC, RoD------------Rosholt	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	Moderate.
RpB*, RpC*: Rosholt---------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	Moderate.
Elderon---------	B	None---------	---	---	>6.0	---	---	>60	---	---	Low-------	Low-------	Moderate.
RrD*: Rosholt---------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	Moderate.
Rock outcrop.													
RsA, RsB--------Rousseau	A	None---------	---	---	3.0-6.0	Apparent	Feb-May	>60	---	---	Low-------	Low-------	Moderate.
RuB, RuC, RuD---Rubicon	A	None---------	---	---	>6.0	---	---	>60	---	---	Low-------	Low-------	High.
SaA, SaB--------Salter Variant	B	None---------	---	---	3.0-6.0	Apparent	Nov-May	>60	---	---	Moderate	Low-------	Low.
SaC-------------Salter Variant	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Low-------	Low.
Sb*. Saprists													
ScA-------------Scott Lake	B	None---------	---	---	3.0-6.0	Apparent	Nov-May	>60	---	---	Moderate	Low-------	High.
Sd--------------Seelyeville	A/D	None---------	---	---	+2-1.0	Apparent	Jan-Dec	>60	---	50-55	High------	High------	Moderate.
SfB, SfC, SfD---Shawano	A	None---------	---	---	>6.0	---	---	>60	---	---	Low-------	Low-------	High.
SgB*, SgC*: Shawano---------	A	None---------	---	---	>6.0	---	---	>60	---	---	Low-------	Low-------	High.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hard-ness	Total subsi-dence	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In		In			
SgB*, SgC*: Briggsville----	C	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	High-----	Moderate.
ShA------------- Shiocton	C	Occasional	Long------	Mar-May	1.0-3.0	Apparent	Sep-Jul	>60	---	---	High-----	Moderate	Low.
SkA------------- Shiocton Variant	C	Rare--------	---	---	1.0-3.0	Apparent	Sep-Jul	>60	---	---	High-----	Moderate	Low.
SoA------------- Solona	C	Rare--------	---	---	1.0-3.0	Apparent	Mar-Jul	>60	---	---	High-----	High-----	Low.
SyB*: Solona---------	C	Rare--------	---	---	1.0-3.0	Apparent	Mar-Jul	>60	---	---	High-----	High-----	Low.
Onaway---------	B	None--------	---	---	3.0-6.0	Apparent	Nov-May	>60	---	---	Moderate	Low------	Moderate.
TlB, TlC2, TlD-- Tilleda	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	Moderate.
TvB, TvC2------- Tilleda Variant	B	None--------	---	---	>6.0	---	---	>60	---	---	Moderate	Low------	Moderate.
WaA------------- Wainola	A	None--------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	Moderate	Low------	Moderate.
Wh-------------- Wheatley	A/D	None--------	---	---	+1-1.0	Apparent	Oct-May	>60	---	---	Moderate	High-----	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

[Tests performed by the Wisconsin Department of Transportation, Division of Highways, in cooperation with the U.S. Department of Transportation, Federal Highway Administration, in accordance with standard procedures of the American Association of State Highway and Transportation Officials (AASHTO) (1). Absence of an entry indicates that no determination was made]

Soil name and location	Parent material	Report number	Depth	Moisture density: Maximum dry density	Moisture density: Optimum moisture	Grain-size distribution: Percentage passing sieve--*: No. 4	No. 10	No. 40	No. 200	Grain-size distribution: Percentage smaller than--*: 0.05 mm	0.02 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index	Classification: AASHTO	Classification: Unified
			In	lb/cu ft	Pct									Pct			
Antigo silt loam: NE1/4NE1/4 sec. 34, T. 28 N., R. 11 E.	Silty deposits over sand and gravel outwash.	S77WI-115-1-1	23-29	-	-	100	100	99	89	85	56	29	23	33.8	12.2	A-6(9)	CL
		S77WI-115-1-2	37-60	-	-	82	78	42	8	8	6	4	3	13.3	NP**	A-1-b (0)	SW-SM
Au Gres loamy sand: NW1/4SW1/4 sec. 20, T. 27 N., R. 15 E.	Sandy outwash	S76WI-115-3-1	22-37	-	-	100	100	97	6	4	2	1	1	-	NP	A-3(0)	SP-SM
		S76WI-115-3-2	37-60	-	-	100	100	89	6	4	2	1	1	-	NP	A-3(0)	SP-SM
Cromwell sandy loam: SW1/4SW1/4 sec. 30, T. 29 N., R. 11 E.	Loamy deposits over sandy outwash.	S78WI-115-32-1	10-17	-	-	97	90	69	31	29	21	8	6	15.5	NP	A-2-4 (0)	SM
		S78WI-115-32-2	43-53	-	-	96	92	35	3	2	2	1	1	-	NP	A-1-b (0)	SW
Elderon gravelly sandy loam: SW1/4SW1/4 sec. 35, T. 29 N., R. 11 E.	Loamy deposits over cobbly, gravelly, sandy glacial drift.	S78WI-115-5-3	15-33	-	-	55	42	18	6	6	5	4	3	22.8	NP	A-1-a (0)	SP-SM
		S78WI-115-5-5	44-60	-	-	38	25	13	5	4	2	1	1	23.1	NP	A-1-a (0)	SP-SM
Fairport fine sandy loam: SE1/4NE1/4NW1/4 sec. 2, T. 26 N., R. 16 E.	Loamy glacial till over dolomite bedrock.	S79WI-115-10-1	11-25	-	-	98	97	91	55	51	43	28	20	31.2	15.2	A-6(6)	CL
		S79WI-115-10-2	30-38	-	-	87	84	78	45	40	30	13	6	16.4	4.0	A-4(2)	SM-SC
Kennan bouldery fine sandy loam***: NE1/4NE1/4 sec. 29, T. 27 N., R. 12 E.	Sandy loam or loamy sand glacial till.	S78WI-115-2-6	25-37	-	-	88	82	63	23	20	14	7	5	13.4	NP	A-2-4 (0)	SM
		S78WI-115-2-8	48-60	-	-	85	81	64	22	21	17	11	9	15.3	NP	A-2-4 (0)	SM

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

Soil name and location	Parent material	Report number	Depth	Moisture density: Maximum dry density	Moisture density: Optimum moisture	Grain-size distribution: Percentage passing sieve--*: No. 4	No. 10	No. 40	No. 200	Percentage smaller than--*: 0.05 mm	0.02 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index	Classification: AASHTO	Unified
			In	lb/cu ft	Pct									Pct			
Menominee loamy sand: NW1/4SW1/4 sec. 21, T. 26 N., R. 16 E.	Sandy outwash over loamy till or lacustrine sediments.	S79WI-115-14-1	36-46	-	-	98	97	92	53	50	45	26	15	28.7	9.4	A-4(4)	CL
		S79WI-115-14-2	46-60	127.8	9.2	91	89	82	42	38	29	14	8	17.8	4.0	A-4(1)	SM-SC
Onaway fine sandy loam***: NE1/4NE1/4 sec. 25, T. 25 N., R. 17 E.	Loamy glacial till.	S79WI-115-11-1	15-23	-	-	-	100	95	58	54	45	32	23	29.1	12.3	A-6(6)	CL
		S79WI-115-11-2	28-60	-	-	73	70	64	38	33	24	14	9	28.8	14.5	A-6(2)	SC
Rosholt fine sandy loam: NE1/4NE1/4 sec. 1, T. 28 N., R. 12 E.	Loamy deposits over sand and gravel outwash.	S77WI-115-2-1	20-28	-	-	100	96	77	36	30	19	10	7	14.8	NP	A-4(0)	SM
		S77WI-115-2-2	34-52	-	-	75	62	21	6	5	4	3	2	-	NP	A-1-b (0)	SP-SM
Rosholt fine sandy loam: NW1/4NW1/4 sec. 27, T. 26 N., R. 11 E.	Loamy deposits over outwash sand, gravel, and cobbles.	S78WI-115-6-4	21-27	-	-	96	95	85	40	36	26	15	12	21.0	6.3	A-4(1)	SM-SC
		S78WI-115-6-8	44-60	-	-	66	61	43	8	6	3	3	2	15.7	NP	A-1-b (0)	SP-SM
Scott Lake loam: NE1/4SW1/4 sec. 12, T. 29 N., R. 11 E.	Loamy deposits over sand and gravel outwash.	S78WI-115-7-5	21-28	-	-	97	93	80	46	41	30	15	11	20.0	4.9	A-4(2)	SM-SC
		S78WI-115-7-8	40-60	130.7	7.6	76	59	27	9	7	6	3	2	17.6	NP	A-1-b (0)	SW-SM
Shawano loamy fine sand: NE1/4NE1/4 sec. 7, T. 26 N., R. 16 E.	Outwash and lacustrine fine sand.	S76WI-115-2-1	13-34	-	-	100	100	100	21	12	4	2	1	-	NP	A-2-4 (0)	SM
		S76WI-115-2-2	34-60	-	-	100	100	100	18	9	3	1	1	-	NP	A-2-4 (0)	SM

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

Soil name and location	Parent material	Report number	Depth	Moisture density: Maximum dry density	Moisture density: Optimum moisture	Grain-size distribution: Percentage passing sieve--*: No. 4	No. 10	No. 40	No. 200	Grain-size distribution: Percentage smaller than--*: 0.05 mm	0.02 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index	Classification: AASHTO	Classification: Unified
			In	lb/cu ft	Pct									Pct			
Shiocton silt loam:																	
SW1/4SW1/4 sec. 32, T. 25 N., R. 17 E.	Stratified silt, silt loam, very fine sandy loam, and very fine sand lacustrine deposits.	S79WI-115-13-1	10-15	-	-	-	-	100	70	62	41	16	8	-	NP	A-4(7)	ML
		S79WI-115-13-2	26-30	-	-	-	-	100	84	73	18	4	3	-	NP	A-4(8)	ML
Solona loam:																	
NW1/4SW1/4 sec. 18, T. 25 N., R. 18 E.	Loamy glacial till.	S78WI-115-34-1	10-18	-	-	89	86	80	47	42	32	21	13	24.0	9.2	A-4(2)	SC
		S78WI-115-34-2	22-60	-	-	85	81	73	46	40	31	19	12	20.7	7.5	A-4(2)	SC

* 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 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 the calculation of grain-size fraction. The mechanical analysis data used in this table are not suitable for use in naming textural classes of soils.

** NP means nonplastic.

*** These soils are taxadjuncts. See the series description for explanation.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alban	Coarse-loamy, mixed Typic Glossoboralfs
Alban Variant	Sandy over loamy, mixed, frigid Alfic Haplorthods
*Angelica	Fine-loamy, mixed, nonacid, frigid Aeric Haplaquepts
Antigo	Fine-silty over sandy or sandy-skeletal, mixed Typic Glossoboralfs
Au Gres	Sandy, mixed, frigid Entic Haplaquods
Au Gres Variant	Mixed, frigid Aquic Udipsamments
*Bach	Coarse-silty, mixed (calcareous), mesic Mollic Haplaquepts
*Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
*Brevort	Sandy over loamy, mixed, nonacid, frigid Mollic Haplaquents
*Briggsville	Fine, mixed, mesic Typic Hapludalfs
Brill	Fine-silty over sandy or sandy-skeletal, mixed Typic Glossoboralfs
Cathro	Loamy, mixed, euic Terric Borosaprists
Cormant	Mixed, frigid Mollic Psammaquents
Cromwell	Sandy, mixed, frigid Typic Dystrochrepts
Croswell	Sandy, mixed, frigid Entic Haplorthods
Elderon	Sandy-skeletal, mixed, frigid Typic Dystrochrepts
Fairport	Fine-loamy, mixed Typic Eutroboralfs
Fluvents	Loamy, mixed, nonacid, frigid Fluvents
Fordum	Coarse-loamy, mixed, nonacid, frigid Mollic Fluvaquents
Iosco	Sandy over loamy, mixed, frigid Alfic Haplaquods
*Kennan	Coarse-loamy, mixed Typic Glossoboralfs
Lorenzo Variant	Coarse-loamy, mixed Typic Argiborolls
Loxley	Dysic Typic Borosaprists
Mahtomedi	Mixed, frigid Typic Udipsamments
*Manawa	Fine, mixed, mesic Aquollic Hapludalfs
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
Oesterle	Coarse-loamy, mixed Aquic Glossoboralfs
*Onaway	Fine-loamy, mixed, frigid Alfic Haplorthods
Plover	Coarse-loamy, mixed Aquic Glossoboralfs
Rosholt	Coarse-loamy, mixed Typic Glossoboralfs
Rosholt Variant	Coarse-loamy, mixed, frigid Entic Haplorthods
Rousseau	Sandy, mixed, frigid Entic Haplorthods
Rubicon	Sandy, mixed, frigid Entic Haplorthods
Salter Variant	Coarse-loamy, mixed Glossic Eutroboralfs
Saprists	Euic Borosaprists
Scott Lake	Coarse-loamy, mixed Typic Glossoboralfs
Seelyeville	Euic Typic Borosaprists
Shawano	Mixed, frigid Typic Udipsamments
Shiocton	Coarse-silty, mixed Aquic Haploborolls
Shiocton Variant	Coarse-loamy, mixed Aquic Haploborolls
Solona	Coarse-loamy, mixed Aquic Eutroboralfs
Tilleda	Fine-loamy, mixed Typic Glossoboralfs
Tilleda Variant	Fine-loamy over sandy or sandy-skeletal, mixed Typic Glossoboralfs
Wainola	Sandy, mixed, frigid Entic Haplaquods
Wheatley	Mixed, frigid Mollic Psammaquents

* This 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.

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