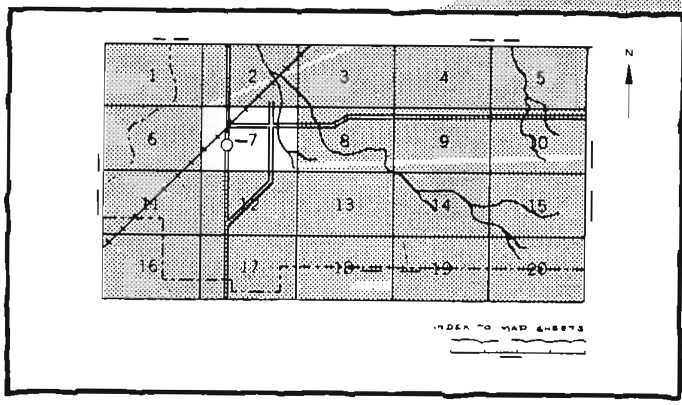
SOIL SURVEY OF

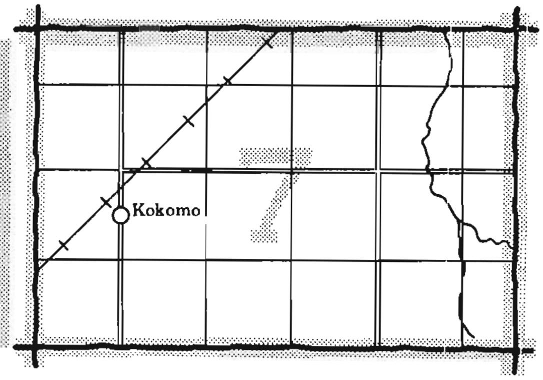
Polk County, Wisconsin

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Research Division of the
College of Agricultural and Life Sciences
University of Wisconsin

HOW TO USE

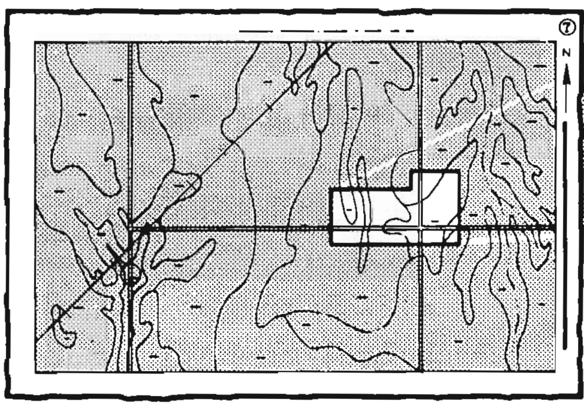
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

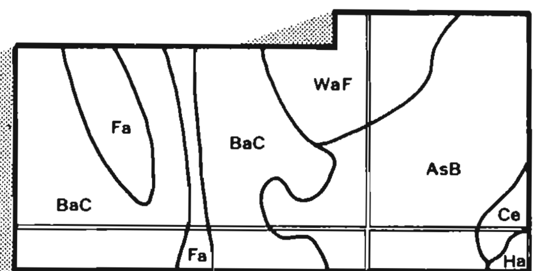




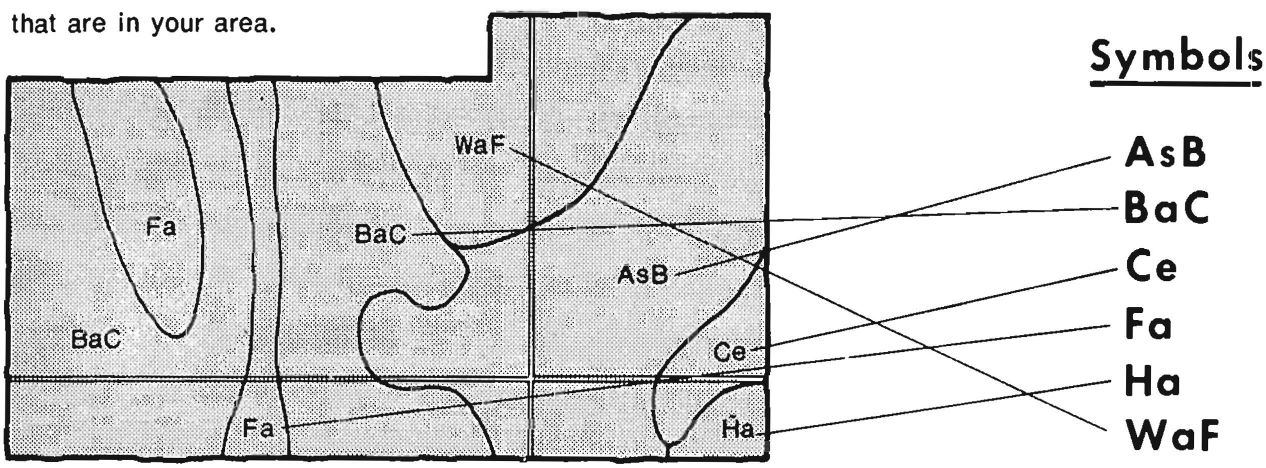
2. Note the number of the map sheet and turn to that sheet.

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



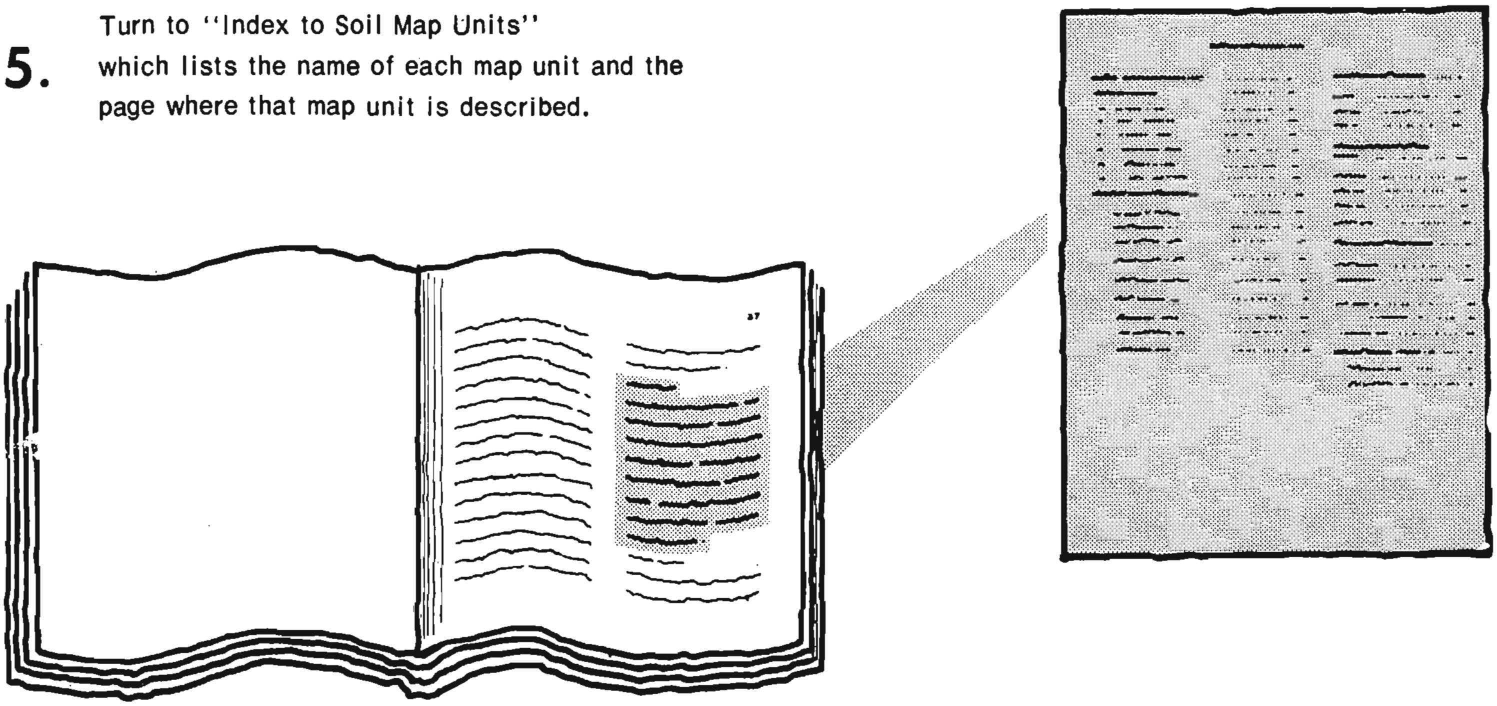


4. List the map unit symbols that are in your area.

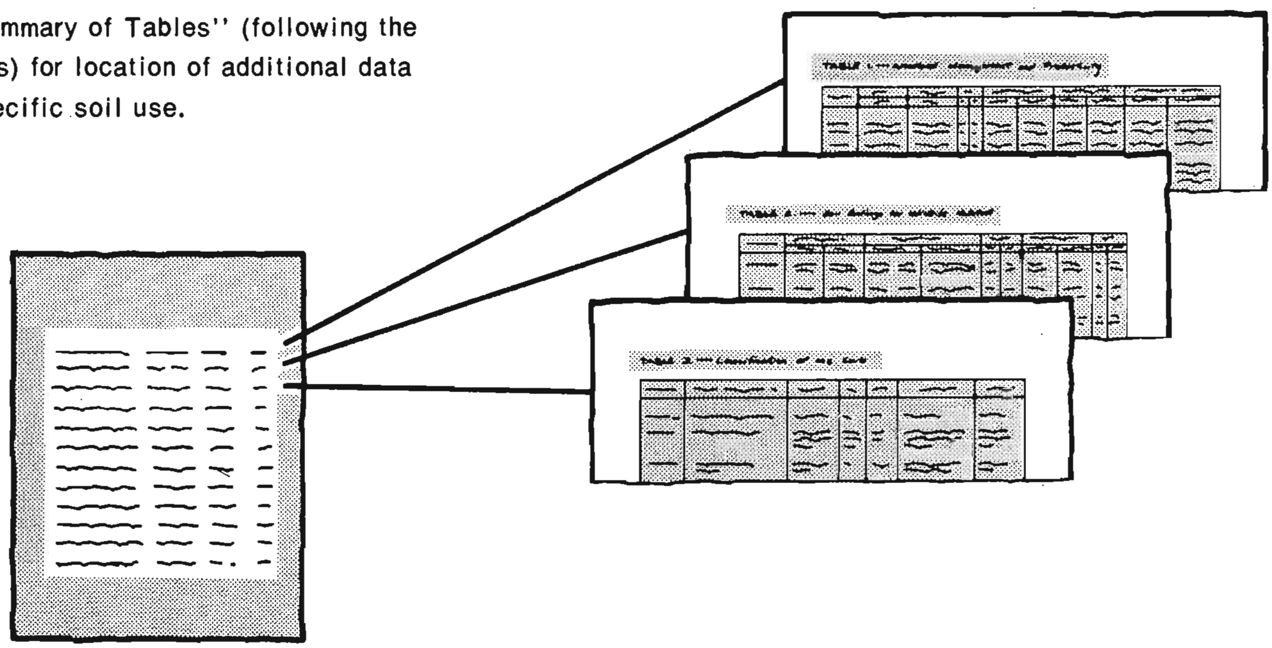


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1973-1975. Soil names and descriptions were approved in March of 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1976. 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 Polk County Soil and Water Conservation District, which helped to finance the mapping.

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

Contents

Issued November 1979

Index to map units

Index to map units—Continued

Summary of tables

Summary of tables—Continued

Foreword

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

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

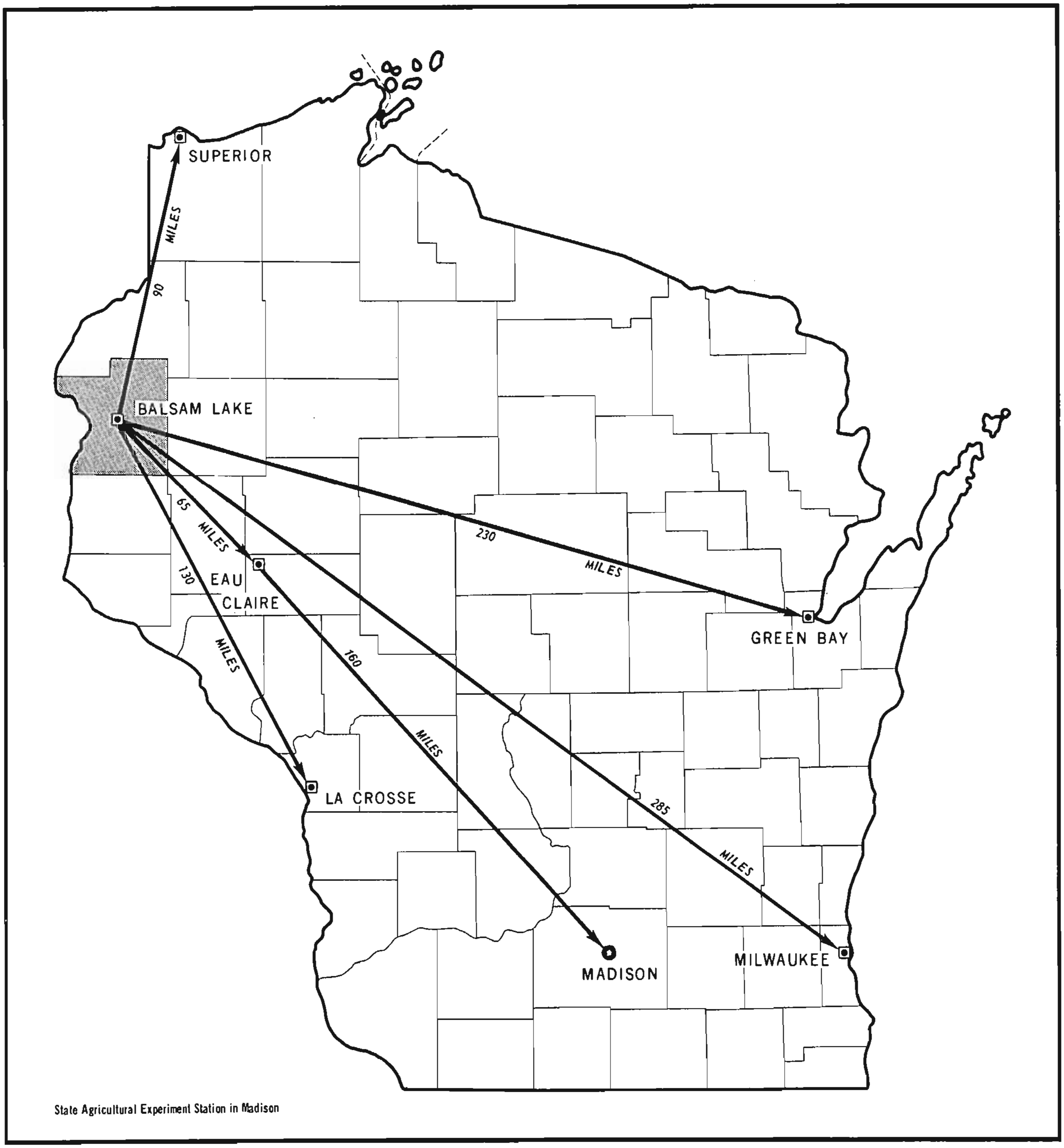
Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

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

J. C. Hytry

J. C. Hytry
State Conservationist
Soil Conservation Service



Location of Polk County in Wisconsin.

SOIL SURVEY OF POLK COUNTY, WISCONSIN

By Everett J. Kissinger, Soil Conservation Service

Fieldwork by Richard W. Diers, Terry J. Huffman, and Everett J. Kissinger, Soil Conservation Service, and by Gordon N. Wing, Polk County Soil and Water Conservation District

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

POLK COUNTY is in the northwestern part of Wisconsin (see map on facing page). It has a total area of 619,520 acres, or 968 square miles. In 1970, it had a population of about 26,500 and a population density of 28.6 per square mile. Balsam Lake, the county seat, has a population of 640 and Amery, the largest town, one of 2,126. The western border is the St. Croix River, which also is the Wisconsin-Minnesota state line. Elevation ranges from about 870 feet in the northwest corner to about 1,300 feet in the east-central part.

General nature of the county

The paragraphs that follow provide general information about the county. They describe climate; geology and underlying material; physiography, relief, and drainage; water supply; history and development; and transportation and industry.

Climate

The climate of Polk County is continental. Summers are warm, and winters are often severely cold. The amount of snow in winter is moderate. In spring and fall, which are often short, many sharp weather changes occur. Temperature and precipitation vary widely from year to year. The county is influenced by the weather systems that frequently move across the country from west to east.

In winter the average temperature is 14.9 degrees F, and the average daily minimum temperature is 5.2 degrees. The lowest temperature on record, which occurred at Amery in February of 1936, is -46 degrees. In summer the average temperature is 68.4 degrees, and the average daily maximum temperature is 80.2 degrees. The highest recorded temperature, which occurred in July of 1936, is 108 degrees.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Amery, for the period 1930 to 1959. The heaviest 1-day rainfall during the period of record was 4.05 inches at Amery in 1953. Thunderstorms occur on 23 to 55 days a year, or on an average of 38 days a year. Hail falls on 0 to 7 days a year, or on an average of 2 days a year.

The average annual precipitation is about 28 inches, 65 percent of which generally falls during the period May through September, which includes the five main months of the growing season. Precipitation is normally adequate for most farm crops, but some soil moisture deficiency is likely in July and August. A severe drought affecting all crops is rare.

The annual snowfall has ranged from 79 inches in 1950 to 18 inches in 1931. The average date of the first snowfall is November 14. Snow falls by October 24 in 1 year in 10 and by December 5 in 9 years in 10.

Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. The average date of the last freeze in the spring is May 15, and that of the first in the fall is September 19. The growing season, or the number of days between the last freeze in the spring and the first in the fall, averages 127 days. It can vary somewhat throughout the county, depending on nearness to water and landscape position. In most valleys and depressional areas, it is slightly shorter than it is on hilltops or side slopes because of cold air drainage.

Records of the wind, sunshine, and relative humidity are not available, but the following data, from Minneapolis, Minnesota, approximate the conditions in Polk County.

The prevailing winds are from the northwest during the period November through April and from the southeast during the rest of the year. The wind is strongest in April, when it averages 13 miles per hour, and is weakest in July and August, when it averages about 9 miles per hour. The highest windspeeds generally occur when the wind is from the northwest, west, or southwest.

The average percentage of possible sunshine is between 60 and 70 in the period June through September, is near 40 in November and December, and is between 50 and 60 for the rest of the year.

Relative humidity is more than 50 percent about 80 percent of the time and is more than 80 percent about 30 percent of the time.

Geology and underlying material

The land surface of Polk County is strongly affected by thick glacial deposits. Sandstone or limestone bedrock is at or near the surface in only a few places. Some low ridges of Keweenawan trap, a rock formation which was originally hot molten lava, are in the north-central part of the county. The erosive action of the St. Croix River has exposed extensive areas of this formation at St. Croix Falls. A large quarry has been established in this formation just south of St. Croix Falls, near Dresser. Most of the crushed rock is used for roads, riprap, and concrete aggregate.

During the last major glacial advance, the Wisconsin stage, ice covered all of Polk County. In general, the ice lowered the preglacial relief because it eroded the tops of the bedrock hills more severely than the valley bottoms.

Two different substages of glaciation are evident in Polk County. The most extensive, the Cary substage, covers most of the county. The Cary-age drift, also known as Young Red Drift of Minnesota, entered the area from the northeast. It was picked up in the Lake Superior region as the ice sheet moved from the Patrician center into Wisconsin and Minnesota. The reddish color probably is derived from the Upper Keweenawan sandstones and shales and the Huronian iron formation.

Mankato-age drift, also known as Young Gray Drift, is in the northwestern part of the county. It entered the county from the northwest. Originating in the Kewatin center, it passed over limestone deposits in southern Canada. Most of this till is calcareous.

Physiography, relief, and drainage

Polk County has a diverse landscape ranging from broad, nearly level glacial outwash and lacustrine plains to rough, broken glacial moraines and areas of pitted outwash. It generally has a young drainage pattern and many closed depressions and pothole lakes. The lakes range widely in size and depth. Among the larger are Balsam Lake, Deer Lake, Cedar Lake, and Lake Wapagasset. Lakes and streams total more than 23,000 acres, or slightly less than 4 percent of the county.

The moraines are rough and broken, having abrupt hills and short, steep ridges near depressions, many of which have no outlets. Between the moraines, the landscape is more nearly level, especially in the central part of the county. Large outwash plains, formed from material carried and deposited by glacial melt water, are mostly nearly level or undulating but in some areas are also pitted with depressions. Lakes, ponds, and bogs are common in the depressions in the moraines and areas of pitted outwash. Some of the outwash deposits provide an important source of sand and gravel, most of which is used as road-building and construction material.

The northwest corner of the county is part of the large area of sand known as the "Pine Barrens," which extends into Polk, Burnett, Douglas, and Bayfield Counties. This area is a sandy outwash plain that has been somewhat reworked by wind.

The southeast corner of the county is an area of long, gentle slopes and broad drainageways. In this area, the soils are dominantly moderately well drained and somewhat poorly drained and the elevation averages about 1,200 feet.

Throughout the eastern part of the county are scattered small areas of nearly level and gently sloping glacial lacustrine plains. Most of the soils on these plains are silty or loamy. They formed in sediments that were deposited in old glacial lakes.

Water supply

The many lakes and streams in the area furnish an abundant supply of surface water. Ground water is readily available in quantities adequate to meet the needs for domestic, agricultural, municipal, and industrial uses.

Well water is available at various depths, depending on the general topography, the distance above permanent stream levels, and the character of the underlying aquifer. A good aquifer has many pores and fissures that are filled with ground water. Sinking wells into these water-filled layers helps to obtain an abundant and constant supply. The level of ground water can rise and fall from season to season and year to year, depending on the amount of rainfall.

Most ground water in Polk County is obtained from sand and gravel aquifers or sandstone aquifers. The sand and gravel aquifers occur as surficial sand and gravel deposits or as isolated buried deposits (*11*).

The surficial sand and gravel deposits are mainly on extensive outwash plains. They are highly permeable and yield large quantities of water to wells. Most high-capacity wells are 40 to 170 feet deep. The specific capacity of these wells generally ranges from 10 to 70 gallons per minute per foot of drawdown. The amount of water drawn from these sand and gravel deposits is insignificant compared to the amount that could be drawn.

The buried sand and gravel deposits are beneath or within most of the ground moraines and end moraines in the county. The size and continuity of most buried aquifers is unknown. The yields from these deposits are small to moderate. Yields of 5 to 15 gallons per minute, adequate for domestic purposes, are obtained from wells in lenses of sand and gravel. These lenses are commonly less than 5 feet thick and are at a depth ranging from 20 to 365 feet.

Sandstone aquifers, important in the southeastern part of the county, provide reliable water supplies. The yields are large or very large. They are as much as 1,500 gallons per minute and average 400 to 500 gallons per minute.

The parts of western and north-central Polk County where glacial drift is shallow over traprock have poor potential for supplying adequate well water. The generally impermeable traprock probably is not an aquifer. Small quantities of water, barely sufficient for domestic purposes, can be obtained from cracks and cleavages in this formation.

Ground water in Polk County is generally of very good quality and is suitable for most purposes. Local differences in quality are the result of the composition, solubility, and surface of the soil and rock through which the water moves and the length of time that the water is in contact with these materials. The main chemical constituents in the water are calcium, magnesium, and bicarbonate ions that are derived primarily from dolomite and glacial drift containing fragments of dolomite. Minor water-use problems are caused by hardness and by high concentrations of iron.

History and development

The Chippewa Indians occupied the area now known as Polk County until 1837, when through a treaty they ceded it and the rest of the upper St. Croix valley to the United States.

The earliest explorer to visit the region was Daniel Du Luth. In 1680, Du Luth came through the Great Lakes to the western end of Lake Superior and then crossed overland to the headwaters of the St. Croix River. He descended the St. Croix River to the Mississippi River. Father Louis Hennepin probably visited what is now Polk County sometime in 1680 or 1681. Later, many of the French explorers, missionaries, and fur traders who used the Brule-St. Croix waterway for access to the upper Mississippi Valley visited the county.

Permanent settlement did not begin until sometime after the War of 1812, when the United States assumed formal control of the Northwest Territory. The first settlement was made at St. Croix Falls in 1837. Lumbering was the chief activity. Virgin pine, most of which was removed during these early years, made up the bulk of the timber in the area, which was then mostly forested.

The county was surveyed in 1845 and established in 1853. It was named in honor of James K. Polk, the eleventh President of the United States. Several changes were made in the original boundaries, and the present boundaries were not established until 1866.

The first railroad, the Northern Wisconsin, was built in June of 1874. It extended across the southeast corner of the county, through Black Brook, for 12 miles. Farming, which is the chief enterprise in the county, began after the forests were cleared. The county was settled somewhat earlier than the counties directly to the east, probably because the river and nearby railroads were available for transportation. The first agricultural community was formed in 1860. The chief exports were wood, lumber, wheat, furs, and mineral water. All of the small grain was marketed to local lumbermen.

By 1880, there were 1,414 farms. The number increased steadily until 1935. Since then, it has been decreasing, while the average size has been increasing dramatically. In 1945, the average farm was 127 acres, and in 1974, it was 184 acres.

Farm ownership has also increased significantly. In 1940, about 72 percent of the farms was fully or partly owned and 28 percent rented. In 1969, about 97 percent of the farms was fully or partly owned and 3 percent rented.

Transportation and industry

A railroad runs through several of the towns and villages in the county (*9*). U.S. Highway 8 is an important east-west road in the area, and State Highway 35 is a scenic western Wisconsin road.

The harvesting of timber for saw logs or pulp is still common (fig. 1). The value of forest products sold, however, has decreased in recent years. The traprock quarry at Dresser, a ground limestone quarry, and sand and gravel pits provide most of the mineral production in the county.

Some small industrial plants have been established in Polk County. They manufacture plastic products, clothing, computer parts, furniture, and other products.

The outdoor recreation industry is rapidly becoming significant in the economy of the county, as is indicated by a strong retail trade. Fishing, canoeing, golfing, and camping are the main recreational activities in summer, and skiing and snowmobiling are popular in winter.

How this survey was made

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

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

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

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

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

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

General soil map for broad land-use planning

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

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

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

1. Cushing-Rifle

Undulating to very hilly, well drained and moderately well drained loamy soils and nearly level, very poorly drained organic soils; on till plains

This map unit is on glacial moraines that have short, uneven slopes, short drainageways, and depressions and pothole lakes. It makes up about 6 percent of the county. It is about 44 percent Cushing soils, 25 percent Rifle soils, and 31 percent soils of minor extent. The undulating to very hilly Cushing soils are on uplands, and Rifle soils are in adjacent lowland areas and depressions.

Cushing soils are well drained and moderately well drained. Permeability is moderately slow, and available water capacity is high. Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer is brown loam about 7 inches thick. The next 4 inches is a mixture of brown and dark brown loam. The subsoil is dark brown sandy clay loam about 22 inches thick. It has some mottles in the lower part. The underlying material to a depth of about 60 inches is dark brown loam.

Rifle soils are very poorly drained organic soils. Permeability is moderately rapid, and available water capacity is very high. The organic layers to a depth of about 60 inches are black and dark reddish brown muck and dark brown mucky peat.

The minor soils in this map unit are the somewhat excessively drained Chetek soils, the somewhat poorly drained Alstad soils, the poorly drained and very poorly drained Bluffton soils, and the very poorly drained Seelyeville and Cathro soils. Alstad soils are intermingled with the Cushing soils in plane to slightly concave areas. Bluffton soils are in shallow depressions or slightly concave areas between Cushing and Rifle soils. Cathro and Seelyeville soils are intermingled with Rifle soils in depressions.

Cushing soils are used mainly for cultivated crops. Some of the hilly and very hilly areas are woodland or pasture. Rifle soils are used mainly for woodland and wildlife habitat. A few areas are pastured.

Erosion is the main limitation in the cultivated areas of Cushing soils. If adequately protected against erosion, these soils have good potential for cultivated crops. They have good potential for woodland. The Rifle soils have poor potential for cultivated crops because of excessive wetness and a frost hazard. They have fair potential for woodland. Both soils have poor potential for residential development because limitations are severe for septic tank absorption fields.

2. Magnor-Freeon

Nearly level and gently sloping, somewhat poorly drained and moderately well drained silty soils on till plains

This map unit is on broad ground moraines that have long, even slopes. It makes up about 6 percent of the county. It is about 33 percent Magnor soils, 25 percent Freeon soils, and 42 percent soils of minor extent.

Magnor soils are somewhat poorly drained. Permeability is moderately slow, and available water capacity is moderate. Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 2 inches thick. The next 7 inches is multicolored silt loam. The subsoil is about 14 inches thick. It is brown, mottled loam in the upper part and reddish brown, mottled sandy loam in the lower part. The underlying material to a depth of about 60 inches is reddish brown, mottled sandy loam.

Freeon soils are moderately well drained. Permeability is moderate or moderately slow, and available water capacity is moderate. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The next 10 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 12 inches thick. It is brown, mottled silt loam in the upper part and reddish brown, mottled sandy loam in the lower part. The underlying material to a depth of about 60 inches is reddish brown sandy loam.

The minor soils in this map unit are the well drained Amery and Santiago soils, the poorly drained Auburndale soils, and the very poorly drained Adolph soils. The more sloping Amery and Santiago soils are on higher uplands. The nearly level Auburndale and Adolph soils are in depressional areas and in drainageways.

Most areas are used for cultivated crops. Wetness and erosion are the main limitations. If adequately drained and protected against excessive erosion, the major soils have good potential for cultivated crops. The potential for woodland is good. The potential for residential development is poor because limitations are severe for septic tank absorption fields.

3. Amery-Santiago-Magnor

Nearly level to very hilly, well drained and somewhat poorly drained loamy and silty soils on till plains

This map unit is on glacial moraines that have short, uneven slopes, short drainageways, and depressions and pothole lakes (fig. 2). It makes up about 37 percent of the county. It is about 45 percent Amery soils, 15 percent Santiago soils, 5 percent Magnor soils, and 35 percent soils of minor extent. Amery and Santiago soils are in similar positions on the landscape. Magnor soils are lower on the landscape or in the less sloping areas.

Amery soils are well drained. Permeability is moderate or moderately slow, and available water capacity is moderate. Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown, dark brown, and dark yellowish brown sandy loam about 16 inches thick. The next 16 inches is a mixture of the subsoil and the subsurface layer. It is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand about 9 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand.

Santiago soils are well drained. Permeability is moderate or moderately slow, and available water capacity is moderate. Typically, the surface layer is very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 9 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 20 inches thick. It is yellowish brown silt loam in the upper part and brown loam and sandy loam in the lower part. The underlying material to a depth of about 60 inches is reddish brown sandy loam.

Magnor soils are somewhat poorly drained. Permeability is moderately slow, and available water capacity is moderate. Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 2 inches thick. The next 7 inches is multicolored silt loam. The subsoil is about 14 inches thick. It is brown, mottled loam in the upper part and reddish brown, mottled sandy loam in the lower part. The underlying material to a depth of about 60 inches is reddish brown, mottled sandy loam.

The minor soils in this map unit are the somewhat excessively drained Cromwell soils, the moderately well drained Freeon soils, the somewhat poorly drained Mora soils, and the very poorly drained Adolph, Rifle, and Seelyeville soils. Cromwell soils are on outwash plains and stream terraces. Freeon and Mora soils are in plane or slightly concave areas at the base of slopes. The nearly level Adolph, Rifle, and Seelyeville soils are in depressional areas.

Much of the acreage is used for cultivated crops or pasture. A large acreage, primarily in the northern part of the county, is woodland. Erosion is the main limitation in cultivated areas. Excessive wetness and impoundment of water are additional problems on Magnor soils.

If adequately protected against erosion, the major soils have good potential for cultivated crops. They also have good potential for woodland. The potential for residential development is only fair because limitations for septic tank absorption fields are moderate or severe.

4. Omega-Newson-Nymore

Nearly level to hilly, somewhat excessively drained, poorly drained, and very poorly drained sandy soils on outwash plains

This map unit is on broad outwash plains that have short, uneven slopes. On these outwash plains, locally known as the "Pine Barrens," fine sand glacial outwash has been reworked by wind and the topography is dune-like.

This map unit makes up about 6 percent of the county. It is about 50 percent Omega soils, 7 percent Newson soils, 6 percent Nymore soils, and 37 percent soils of minor extent. The nearly level and undulating Nymore soils are intermingled with the more sloping Omega soils. The nearly level Newson soils are in broad depressional areas and in drainageways.

Omega soils are somewhat excessively drained. Permeability is rapid, and available water capacity is low. Typically, the surface layer is very dark brown fine sand about 2 inches thick. The subsoil is reddish brown fine sand about 19 inches thick. The underlying material to a depth of about 60 inches is yellowish red fine sand.

Newson soils are poorly drained and very poorly drained. Permeability is rapid, and available water capacity is low. Typically, the surface layer is very dark gray loamy fine sand about 8 inches thick. The subsoil is grayish brown, mottled loamy fine sand about 16 inches thick. The underlying material to a depth of about 60 inches is light brown, light yellowish brown, and reddish brown fine sand. It is mottled in the upper part.

Nymore soils are somewhat excessively drained. Permeability is rapid, and available water capacity is low. Typically, the surface layer is dark brown fine sand about 8 inches thick. The subsoil is dark brown and brown fine sand about 30 inches thick. The underlying material to a depth of about 60 inches is strong brown, mottled fine sand.

The minor soils in this map unit are the moderately well drained Croswell soils; the somewhat poorly drained Lino soils; the moderately well drained and somewhat poorly drained Fluvaquents and poorly drained and very poorly drained Fluvaquents, wet; and the very poorly drained Markey soils. Croswell and Lino soils are throughout the map unit. Markey soils are in depressions adjacent to Newson soils. Fluvaquents and Fluvaquents, wet, are on flood plains.

Most areas are woodland. Droughtiness and soil blowing are the main limitations if cultivated crops are grown. Excessive wetness is an additional problem on Newson soils. Unless irrigated, the major soils are too droughty for cultivated crops. They have potential as irrigated cropland. The potential for woodland is fair or poor. The Omega and Nymore soils have good potential for residential development, but the effluent from septic tank absorption fields can pollute ground water. The Newson soils have poor potential for residential development.

5. Antigo-Rosholt

Nearly level to sloping, well drained silty and loamy soils on outwash plains

This map unit is on broad outwash plains and in some more sloping areas along drainageways and in depressions (fig. 3). It makes up about 12 percent of the county. It is about 70 percent Antigo soils, 20 percent Rosholt soils, and 10 percent soils of minor extent.

Antigo soils are moderately permeable in the upper part and very rapidly permeable in the underlying material. Available water capacity is moderate. Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 14 inches thick. It is dark yellowish brown silt loam in the upper part and dark brown loam in the lower part. The underlying material to a depth of about 60 inches is dark brown and reddish brown, stratified coarse sand and sand and gravel.

Rosholt soils are moderately permeable in the upper part and very rapidly permeable in the underlying material. Available water capacity is moderate. Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 7 inches thick. The next 12 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 11 inches thick. It is dark brown sandy loam in the upper part and dark brown loamy coarse sand in the lower part. The underlying material to a depth of about 60 inches is brown, dark brown, and strong brown, stratified coarse sand and fine gravel.

The minor soils in this map unit are the moderately well drained Brill soils and the somewhat poorly drained Poskin soils in concave or depressional areas.

Most areas are used for cultivated crops. Maintaining tilth and controlling erosion in the sloping areas are the main concerns in managing the major soils for cultivated crops. These soils have good potential for cultivated crops, woodland, and residential development.

6. Burkhardt-Dakota

Nearly level to sloping, somewhat excessively drained and well drained loamy soils on outwash plains

This map unit is on broad outwash plains and stream terraces (fig. 4). It makes up about 2 percent of the county. It is about 60 percent Burkhardt soils, 20 percent Dakota soils, and 20 percent soils of minor extent.

Burkhardt soils are somewhat excessively drained. Permeability is moderately rapid in the upper part and rapid in the lower part. Available water capacity is low. Typically, the surface layer is very dark brown sandy loam about 11 inches thick. The subsoil is about 13 inches thick. It is dark brown sandy loam in the upper part and brown loamy coarse sand in the lower part. The underlying material to a depth of about 60 inches is yellowish brown, stratified coarse sand and gravel.

Dakota soils are well drained. Permeability is moderate in the upper part and very rapid in the underlying material. Available water capacity is moderate. Typically, the surface layer is very dark brown and very dark grayish brown loam about 16 inches thick. The subsoil is about 22 inches thick. It is dark brown and dark yellowish brown loam in the upper part and dark brown and strong brown loamy sand and sand in the lower part. The underlying material to a depth of about 60 inches is light yellowish brown, stratified sand and coarse sand and gravel.

The minor soils in this map unit are the somewhat excessively drained Hubbard soils and the somewhat poorly drained Dakota Variant. Hubbard soils are intermingled with Burkhardt soils. The Dakota Variant is in broad, slightly concave areas on outwash plains and in drainageways.

Most areas are used for cultivated crops. Maintaining tilth and fertility and controlling erosion in sloping areas are the main concerns in managing the major soils for cultivated crops. Droughtiness is an additional limitation on Burkhardt soils. The potential for cultivated crops is good. The major soils are not naturally forested and generally are not managed as woodland. The potential for residential development is good, but the effluent from septic tank absorption fields can pollute ground water.

7. Rosholt-Cromwell-Menahga

Nearly level to very hilly, well drained and somewhat excessively drained loamy and sandy soils on pitted outwash plains

This map unit is on pitted glacial outwash plains that have short, uneven slopes, many closed drainageways, and common depressions and pothole lakes (fig. 5). It makes up about 28 percent of the county. It is about 20 percent Rosholt soils, 20 percent Cromwell soils, 18 percent Menahga soils, and 42 percent soils of minor extent.

Rosholt soils are well drained. Permeability is moderate in the upper part and very rapid in the underlying material. Available water capacity is moderate. Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 7 inches thick. The next 12 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 11 inches thick. It is dark brown sandy loam in the upper part and dark brown loamy coarse sand in the lower part. The underlying material to a depth of about 60 inches is brown, dark brown, and strong brown, stratified coarse sand and fine gravel.

Cromwell soils are somewhat excessively drained. Permeability is moderate in the upper part and rapid in the lower part. Available water capacity is low. Typically, the surface layer is black sandy loam about 1 inch thick. The subsurface layer is dark brown sandy loam about 2 inches thick. The subsoil is about 27 inches thick. It is dark brown sandy loam in the upper part and dark brown cobbly loamy sand and sand in the lower part. The underlying material to a depth of about 60 inches is brown and dark brown sand.

Menahga soils are somewhat excessively drained. Permeability is rapid, and available water capacity is low. Typically, the surface layer is black loamy sand about 1 inch thick. The subsurface layer is dark grayish brown loamy sand about 2 inches thick. The subsoil is dark yellowish brown loamy sand or brown sand about 22 inches thick. The underlying material to a depth of about 60 inches is brown sand.

The minor soils in this map unit are the excessively drained Emmert soils, the somewhat excessively drained Chetek soils, the well drained Antigo soils, the somewhat poorly drained Cromwell Variant and Poskin soils, the poorly drained and very poorly drained Warman Variant, and the very poorly drained Cathro, Markey, Rifle, and Seelyeville soils. Emmert soils are on small kames and eskers. Chetek and Antigo soils are throughout the map unit. The Cromwell and Warman Variants are in depressional areas. Cathro, Markey, Seelyeville, and Rifle soils are in depressions and drainageways.

Much of the acreage is used for cultivated crops. Many areas, especially the more sloping areas, are pasture or woodland. Erosion and droughtiness are the main limitations in managing the major soils for cultivated crops. Soil blowing is an additional hazard on Menahga soils. The potential is poor for cultivated crops and fair or good for woodland. The potential for residential development is good, but the effluent from septic tank absorption fields can pollute ground water.

8. Alban-Campia-Comstock

Nearly level to moderately steep, well drained and somewhat poorly drained loamy and silty soils on glacial lake plains

This map unit is in broad old glacial lakebeds and in some steeper areas along drainageways and in depressions. It makes up about 3 percent of the county. It is about 35 percent Alban soils, 15 percent Campia soils, 12 percent Comstock soils, and 38 percent soils of minor extent.

Alban soils are well drained. Permeability is moderate, and available water capacity is high. Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown sandy loam about 12 inches thick. The next 24 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark brown fine sandy loam about 3 inches thick. The underlying material to a depth of about 60 inches is brown fine sandy loam and strong brown fine sand and sand.

Campia soils are well drained. Permeability is moderate, and available water capacity is very high. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The next 13 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark brown silt loam about 15 inches thick. The underlying material to a depth of about 60 inches is dark yellowish brown, mottled silt.

Comstock soils are somewhat poorly drained. Permeability is moderate, and available water capacity is very high. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown and grayish brown, mottled silt loam about 7 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dominantly dark yellowish brown and yellowish brown, mottled silt loam about 23 inches thick. It has thin strata of fine and very fine sand in the lower part. The underlying material to a depth of about 60 inches is yellowish brown, stratified silt, silt loam, and very fine sand.

The minor soils in this map unit are the moderately well drained Crystal Lake soils, the somewhat poorly drained Plover soils, and the poorly drained Barronett soils and Barronett Variant. The nearly level and gently sloping Crystal Lake and Plover soils are intermingled with Campia and Alban soils. The nearly level Barronett soils and Barronett Variant are in depressional areas.

Most areas are used for cultivated crops. Maintaining tilth and fertility is the main concern in managing the major soils for cultivated crops. Erosion is a hazard in the more sloping areas, and excessive wetness is a problem on the Comstock soils. The potential is good for cultivated crops and woodland. The potential for residential development is only fair because in some areas the slope and the excessive wetness are moderate or severe limitations for septic tank absorption fields.

Soil maps for detailed planning

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

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

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

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Amery series, for example, was named for the town of Amery in Polk County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Amery sandy loam, 1 to 6 percent slopes, is one of several phases within the Amery series.

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

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Rosholt-Cromwell complex, 2 to 6 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 there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Saprists and Aquents is an undifferentiated group in this survey area.

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

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

The acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

In the descriptions on the following pages, statements are made about the suitability and potential of soils for various uses and about means of overcoming limitations for those uses. Some of the methods are controlled by local or State ordinances, which should be referred to before construction.

Ad—Adolph silt loam. This nearly level, very poorly drained soil is in drainageways and depressions on glacial moraines. It is subject to flooding. Individual areas are irregular in shape and are generally 2 to 20 acres in size. Scattered stones are on the surface in most areas.

Typically, the surface layer is black and very dark gray silt loam about 10 inches thick. The subsoil is about 21 inches thick. The upper part is dark gray and gray, mottled silt loam; the lower part is pinkish gray, mottled sandy loam. The underlying material to a depth of about 60 inches is brown, mottled sandy loam. In places the surface layer is loam. In some areas the upper part of the underlying material is loamy sand or gravelly loamy sand.

Included with this soil in mapping are small areas of very poorly drained Cathro soils in shallow depressions. Also included are small areas of Freeon and Magnor soils. The moderately well drained Freeon soils are in the higher convex areas on the landscape. The somewhat poorly drained Magnor soils are in slightly higher positions. Included areas make up 5 to 10 percent of the unit.

Permeability is moderately slow, and available water capacity is high. Surface runoff is very slow, and ponding is likely after heavy rains because the soil receives runoff from adjacent slopes. Organic-matter content is very high, and tilth is good. Unless the soil is drained, the upper foot is saturated during wet periods. The roots of some plants are restricted by the high water table.

Most areas are pasture or woodland. The potential is fair for pasture and poor for cultivated crops, woodland, and most engineering uses.

Because of the high water table, this soil is poorly suited to growing row crops and small grain. Providing artificial drainage is difficult because in many areas an adequate outlet is not readily available. In areas where an adequate outlet is available, providing surface drainage and diverting the runoff from adjacent slopes improve the suitability for cultivated crops. This excessively wet soil warms up slowly in spring. The number of frost-free days during the growing season is less on this soil than on the adjacent upland soils because of cold air drainage.

This soil is suited to growing grasses and clover for hay and pasture. If good surface drainage is provided, grasses and red clover can be grown. In undrained areas suitable grasses are restricted to such species as reed canarygrass. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is poorly suited to woodland. Trees grow slowly and have poor form. In areas where natural regeneration is unreliable, they generally should be planted on prepared ridges because the soil is wet. Selection of large, vigorous nursery stock helps to prevent high mortality of planted seedlings. Harvest is frequently limited to periods when the ground is frozen. Clear-cut or group-selection harvest methods reduce the danger of windthrow to the remaining trees. Control of competing vegetation by suitable herbicides or mechanical removal permits natural regeneration.

This soil is generally unsuited to septic tank absorption fields because of the high water table and the ponding. It is poorly suited as a site for dwellings and local roads and streets. Artificial drainage is needed on building sites. Diverting the runoff from adjacent slopes reduces wetness and ponding. Filling with suitable base material is needed if local roads and streets are built on this soil.

Capability subclass IIIw; woodland suitability subclass 5w.

AfA—Alban fine sandy loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad glacial lake plains. Individual areas are irregular in shape and generally are 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown sandy loam about 12 inches thick. The next 24 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark brown fine sandy loam about 3 inches thick. The underlying material to a depth of about 60 inches is brown fine sandy loam and strong brown fine sand and sand. In places the surface layer is loamy fine sand, very fine sandy loam, or loam.

Included with this soil in mapping are small areas of the poorly drained Barronett soils in drainageways and shallow depressions and small areas of the somewhat poorly drained Plover soils on concave slopes. Also included are small areas where this soil has a slope of more than 2 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderate, and available water capacity is high. Surface runoff is slow. Organic-matter content is moderate.

Almost all of the acreage is farmed. Only a few areas are pasture or woodland. The potential is good for cultivated crops, pasture, woodland, and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the grasses and legumes used for pasture. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees that are used for wood products. The only soil related forest management problem is competition from brushy vegetation following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is suitable as a site for septic tank absorption fields and dwellings. It lacks the strength needed to support vehicular traffic. Providing suitable base and subbase material helps to prevent the road damage resulting from low strength and frost action.

Capability class I; woodland suitability subclass 2o.

AfB—Alban fine sandy loam, 2 to 6 percent slopes. This undulating, well drained soil is on broad glacial lake plains. Individual areas are irregular in shape and generally are 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is brown sandy loam about 10 inches thick. The next 20 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark brown fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches is brown and strong brown fine sandy loam, fine sand, and sand. In places the surface layer is loamy fine sand, very fine sandy loam, or loam. In a few areas it is thicker and darker.

Included with this soil in mapping are small areas of the poorly drained Barronett soils in drainageways and shallow depressions and small areas of the somewhat poorly drained Plover soils on concave slopes. Also included are a few areas where slopes are short and more than 6 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderate, and available water capacity is high. Surface runoff is slow. Organic-matter content is moderate.

Most areas are farmed. A few are pasture or woodland. The potential is good for cultivated crops, pasture, woodland, and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations, however, can prevent excessive soil loss. In most areas row crops can be grown year after year without excessive soil loss if tillage is kept to a minimum. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

The soil is suited to trees that are used for wood products. The only soil related forest management problem is competition from brushy vegetation following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is suitable as a site for septic tank absorption fields and dwellings. It lacks the strength needed to support vehicular traffic. Providing suitable base and subbase material helps to prevent the road damage resulting from low strength and frost action.

Capability subclass IIe; woodland suitability subclass 2o.

AfC2—Alban fine sandy loam, 6 to 12 percent slopes, eroded. This rolling, well drained soil is on broad glacial lake plains. Individual areas are irregular in shape and generally are 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The next 20 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark brown fine sandy loam about 8 inches thick. The underlying material to a depth of about 60 inches is brown and strong brown fine sandy loam, fine sand, and sand. In some areas the soil is uneroded and has a brown sandy loam subsurface layer about 10 inches thick. In places the surface layer is loamy fine sand, very fine sandy loam, or loam.

Included with this soil in mapping are small areas of the poorly drained Barronett soils in drainageways and shallow depressions and small areas of the Plover soils on concave slopes. Also included are a few areas where slopes are short and more than 12 percent, some areas where slopes are less than 6 percent, and a few small scattered areas of the droughty Menahga soils. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate, and available water capacity is high. Surface runoff is moderate in cultivated areas and slow in other areas. Organic-matter content is low. Erosion has lowered the organic-matter content, the fertility level, and the capacity of the soil to retain water and resulted in poorer tilth in the surface layer.

Most areas are used for cultivated crops. A few are pasture or woodland. The potential is good for cultivated crops, pasture, and woodland and fair for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of further erosion is moderate. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations, however, can prevent excessive soil loss. Minimum tillage, winter cover crops, and spring plowing help to reduce soil loss in row cropped areas. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brushy vegetation following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is moderately suited as a site for septic tank absorption fields and dwellings. It lacks the strength needed to support vehicular traffic. Providing suitable base and subbase material helps to prevent the road damage resulting from low strength and frost action. Because of the slope, land shaping is needed if this soil is used as a building site. The less sloping included areas are better building sites.

Capability subclass IIIe; woodland suitability subclass 2o.

AfD—Alban fine sandy loam, 12 to 20 percent slopes. This hilly, well drained soil is on dissected glacial lake plains and terraces. Individual areas are irregularly shaped or long and narrow and generally are 3 to 15 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 2 inches thick. The subsurface layer is brown sandy loam about 10 inches thick. The next 18 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark brown fine sandy loam about 10 inches thick. The underlying material to a depth of about 60 inches is brown and strong brown fine sandy loam, fine sand, and sand. In places the surface layer is loamy fine sand, very fine sandy loam, loam, or silt loam. In cultivated areas, which commonly are moderately eroded, plowing has mixed most or all of the subsurface layer with the surface layer. In places, generally adjacent to areas of Campia soils, the subsoil contains more silt and less sand.

Included with this soil in mapping are small depressional areas of poorly drained Barronett soils and somewhat poorly drained Plover soils. Also included are scattered small areas of the droughty Menahga soils and a few areas where slopes are short and more than 20 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate, and available water capacity is high. Surface runoff is rapid in cultivated areas. Organic-matter content is moderate.

Most areas are pasture or woodland. A few are used for cultivated crops. The potential is good for pasture and woodland, fair for cultivated crops, and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is severe. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations, however, help to prevent excessive soil loss. Minimum tillage, winter cover crops, and spring plowing help to reduce soil losses in row cropped areas. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

The use of this soil as pasture is effective in controlling erosion. The soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The soil related forest management problems are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Seedling survival on the steeper slopes facing south or west can be improved by care in planting and by selection of vigorous planting stock. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because of the slope, dwellings and septic tank absorption fields generally cannot be constructed on this soil without extensive land shaping. They can be constructed in some of the less steep included areas. If roads are built, extensive cutting and filling generally is needed because of the slope. Providing suitable base material helps to prevent the road damage resulting from low strength and frost action.

Capability subclass IVe; woodland suitability subclass 2r.

Ag—Alstad loam, 0 to 3 percent slopes. This nearly level and undulating, somewhat poorly drained soil occurs as plane or slightly concave areas on glacial moraines. It is subject to rare flooding. Individual areas are irregular in shape and generally are 4 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loam about 11 inches thick. The subsurface layer is brown, mottled loam about 5 inches thick. The next 22 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 13 inches thick. It is dark brown, mottled clay loam in the upper part and dark brown, mottled loam in the lower part. The underlying material to a depth of about 60 inches is brown, mottled loam. In places the surface layer is sandy loam or silt loam. In some areas the underlying material has bands of sand or gravelly sand.

Included with this soil in mapping are small areas of the well drained and moderately well drained Cushing soils on convex slopes and small areas of the poorly drained and very poorly drained Bluffton soils in shallow depressions. Also included are small areas where the slope is more than 3 percent. Included areas make up 2 to 12 percent of the unit.

Permeability is moderately slow, and available water capacity is high. Runoff is slow. In some areas that receive runoff from adjacent slopes, ponding is likely to occur for brief periods after a heavy rainfall. Organic-matter content is moderate, and tilth is good. Water saturates the upper 1 foot to 3 feet during wet periods unless the soil is drained.

Most areas are farmed. Some are wooded or pastured. The potential is good for cultivated crops, woodland, and pasture and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches and, in some areas, diversions and land smoothing is needed for dependable crop production. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. It should be drained if a taprooted plant, such as alfalfa, is grown. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brushy vegetation following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is poorly suited as a site for septic tank absorption fields because of the seasonal high water table and the moderately slow permeability. It also is poorly suited as a site for dwellings and local roads and streets. Building a filtering mound of suitable material improves septic tank absorption fields. Sites for dwellings should be drained. Diversions are needed to protect the site from ponding. Filling with suitable base material is needed to protect roads and streets from the damage resulting from low strength and frost action.

Capability subclass IIw; woodland suitability subclass 2o.

AlB—Amery sandy loam, 1 to 6 percent slopes. This nearly level and undulating, well drained soil is on plane or convex ridgetops on glacial moraines. Individual areas are irregular in shape and generally are 5 to 40 acres in size. Scattered stones are on the surface in many areas.

Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown, dark brown, and dark yellowish brown sandy loam about 15 inches thick. The next 16 inches is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand about 9 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand. In cultivated areas plowing has mixed the upper part of the subsurface layer with the surface layer. In some areas the surface layer is loam or loamy sand.

Included with this soil in mapping are small areas of Cromwell, Freeon, Magnor, Mora, and Rosholt soils. The moderately well drained Freeon soils and the somewhat poorly drained Magnor and Mora soils are in small concave areas or in shallow depressions. Cromwell and Rosholt soils are underlain by sand and gravel. They are intermingled with Amery soils. Also included are a few areas where slopes are short and more than 6 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is moderate. Runoff is slow in cultivated areas. Organic-matter content is moderate, and the soil can be easily tilled throughout a fairly wide range in moisture content. The penetration of roots is somewhat restricted by compact glacial till below a depth of about 30 inches.

Many areas are farmed. Other areas remain wooded. The potential is good for cultivated crops, pasture, and woodland and fair for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is slight or moderate. In most areas slopes are too short and irregular for strip-cropping, terracing, or farming on the contour. Proper crop rotations, minimum tillage, and winter cover crops in combination with spring plowing help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. As a result of the moderate available water capacity, crop yields are limited during dry periods.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brushy vegetation following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is moderately suited to septic tank absorption fields. In some areas it is too slowly permeable, but increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome this limitation. The soil lacks the strength needed to support vehicular traffic. Providing suitable base and subbase material helps to prevent the damage to roads and streets resulting from low strength and frost action.

Capability subclass IIe; woodland suitability subclass 2o.

AIC—Amery sandy loam, 6 to 12 percent slopes. This rolling, well drained soil is on convex ridgetops or side slopes on glacial moraines. Individual areas are irregular in shape and generally are 5 to 50 acres in size. Slopes are short and uneven, and shallow depressions are common. Scattered stones are on the surface in most areas.

Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown, dark brown, and dark yellowish brown sandy loam about 16 inches thick. The next 16 inches is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand about 9 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand. In some areas the surface layer is loam or loamy sand. In cultivated areas, which commonly are moderately eroded, plowing has mixed most of the subsurface layer with the surface layer.

Included with this soil in mapping are small areas of Cromwell, Magnor, Mora, and Rosholt soils. The somewhat poorly drained Magnor and Mora soils are in small concave areas or in shallow depressions. Cromwell and Rosholt soils are underlain by sand and gravel. They are intermingled with Amery soils. Also included are areas where the slope is more than 12 percent and a few small areas where it is less than 6 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is moderate. Runoff is moderate in cultivated areas. Organic-matter content is moderate. Root penetration is somewhat restricted by compact glacial till below a depth of about 30 inches.

Many areas remain wooded. Some are farmed. The potential is good for pasture and woodland and fair for cultivated crops and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is moderate. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations, minimum tillage, and winter cover crops in combination with spring plowing help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. As a result of the moderate available water capacity, crop yields are limited during dry periods.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brushy vegetation following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is moderately suited to septic tank absorption fields. In some areas it is too slowly permeable, but increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome this limitation.

The slope limits this soil as a site for dwellings, but this limitation can be overcome by land shaping or avoided by constructing buildings in the less sloping included areas. The soil lacks the strength needed to support vehicular traffic. Providing suitable base and subbase material helps to prevent the damage to roads and streets resulting from low strength and frost action.

Capability subclass IIIe; woodland suitability subclass 2o.

AID—Amery sandy loam, 12 to 20 percent slopes. This hilly, well drained soil is on convex ridgetops or side slopes on glacial moraines. Individual areas are irregular in shape and generally are 5 to 50 acres in size. Slopes are short and uneven, and shallow depressions are common. In most areas scattered stones are on the surface.

Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown, dark brown, and dark yellowish brown sandy loam about 16 inches thick. The next 16 inches is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand about 9 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand. In some areas the surface layer is loam or loamy sand. In cultivated areas, which commonly are moderately eroded, plowing has mixed most of the subsurface layer with the surface layer.

Included with this soil in mapping are small areas of Adolph, Cromwell, Magnor, Rosholt, and Seelyeville soils. The somewhat poorly drained Magnor soils are in concave areas and on the narrow margins of depressions. The very poorly drained Adolph and Seelyeville soils occupy small depressions. Cromwell and Rosholt soils are underlain by sand and gravel. They are intermingled with Amery soils. Also included are a few areas where the slope is more than 20 percent and small areas where it is less than 12 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is moderate. Runoff is rapid in cultivated areas. Organic-matter content is moderate. Root penetration is somewhat restricted by compact glacial till below a depth of about 30 inches.

Most areas remain wooded. Some are farmed. The potential is poor for cultivated crops, good for pasture and woodland, and fair for most engineering uses.

This soil is poorly suited to growing corn and small grain and well suited to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is severe. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations, minimum tillage, or winter cover crops in combination with spring plowing help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. Small wet depressions interfere with cultivation. Draining these depressions is difficult. As a result of the moderate available water capacity, crop yields are limited during dry periods.

The use of this soil as pasture is effective in controlling erosion. The soil is suited to many of the pasture grasses and legumes. Overgrazing, however, results in surface compaction, poor tilth, and excessive erosion. Proper stocking rates and pasture rotation keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The soil related forest management problems are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Seedling survival on the steeper slopes facing south or west can be improved by care in planting and by selection of vigorous planting stock. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because this soil is hilly and moderately or moderately slowly permeable, it is poorly suited to septic tank absorption fields. Increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome the excessively slow permeability. The less sloping included areas are better sites for septic tank absorption fields.

The slope limits this soil as a site for dwellings, but this limitation can be overcome by land shaping or avoided by constructing buildings in the less sloping included areas. Because of the slope, extensive cutting and filling generally is needed if local roads and streets are built. The soil lacks the strength needed to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the base material.

Capability subclass IVe; woodland suitability subclass 2r.

AIE—Amery sandy loam, 20 to 30 percent slopes. This steep or very hilly, well drained soil is on convex ridgetops or side slopes on glacial moraines. Individual areas are irregular in shape and generally are 5 to 25 acres in size. Slopes are short and uneven, and shallow depressions are common. In most areas scattered stones are on the surface.

Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown, dark brown, and dark yellowish brown sandy loam about 12 inches thick. The next 14 inches is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand about 7 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand. In some areas the surface layer is loam or loamy sand. A few areas have been cultivated and are eroded.

Included with this soil in mapping are small areas of Adolph, Cromwell, Magnor, Rosholt, and Seelyeville soils. The somewhat poorly drained Magnor soils are in concave areas on the margins of depressions. The very poorly drained Adolph and Seelyeville soils are in small depressions. Cromwell and Rosholt soils are underlain by sand and gravel. They are intermingled with Amery soils. Also included are a few areas where the slope is more than 30 percent and small areas where it is less than 20 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is moderate. Organic-matter content also is moderate. Root penetration is somewhat restricted by compact glacial till below a depth of about 30 inches.

Most areas are woodland. A few are pasture. The potential is good for woodland, fair for pasture, and poor for cultivated crops and most engineering uses.

The hazard of erosion is severe. As a result, this soil generally is unsuitable for cultivated crops. Under such intensive management as contour farming in combination with minimum tillage, a limited number of row crops can be included in the crop rotation without excessive soil loss. Small wet depressions interfere with cultivation. Draining these depressions is difficult.

The use of this soil as pasture or hayland is effective in controlling erosion. The soil is poorly suited to growing many of the pasture grasses and legumes. The slope can hinder the machinery that is used when pasture is renovated. Overgrazing results in surface compaction, poor tilth, and excessive erosion. Proper stocking rates and pasture rotation keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The soil related problems of forest management are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Care in planting and selection of vigorous planting stock improve seedling survival on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because this soil is steep or very hilly and moderately or moderately slowly permeable, it is poorly suited to septic tank absorption fields. Increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome the excessively slow permeability. The less steep included areas are better sites for septic tank absorption fields.

The slope limits this soil as a site for dwellings, but this limitation can be overcome by land shaping or avoided by constructing buildings in the less steep included areas. Because of the slope, extensive cutting and filling generally is needed if local roads and streets are built. The soil lacks the strength needed to support vehicular traffic, but this limitation can be overcome by strengthening or replacing the base material.

Capability subclass VIe; woodland suitability subclass 2r.

AnB—Amery silt loam, 1 to 6 percent slopes. This nearly level and undulating, well drained soil is on plane or convex ridgetops on glacial moraines. Individual areas are irregular in shape and generally are 5 to 40 acres in size. In many areas scattered stones are on the surface.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is brown and dark brown silt loam about 10 inches thick. The next 15 inches is a mixture of the subsoil and the subsurface layer. The subsoil is reddish brown and yellowish red sandy loam about 10 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red sandy loam. In some areas the upper part of the subsoil is silt loam or loam. In cultivated areas plowing has mixed the upper part of the subsurface layer with the surface layer. In some areas the surface layer is loam.

Included with this soil in mapping are small areas of Freeon and Magnor soils. The moderately well drained Freeon soils occupy small concave slopes. The somewhat poorly drained Magnor soils occupy small concave slopes and shallow depressions. Also included are small areas of a soil that is underlain by sand and gravel and a few areas where slopes are short and more than 6 percent. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is moderate. Runoff is slow in cultivated areas. Organic-matter content is moderate. Tilth is good, but the soil tends to crust or puddle after heavy rains. Root penetration is somewhat restricted by compact glacial till below a depth of about 30 inches.

Some areas are farmed, and others remain wooded. The potential is good for cultivated crops, pasture, and woodland and fair for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is slight or moderate. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations, minimum tillage, and winter cover crops in combination with spring plowing help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. As a result of the moderate available water capacity, crop yields are limited during dry periods.

This soil is well suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is moderately suited to septic tank absorption fields. In some areas it is too slowly permeable, but increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome this limitation. The soil lacks the strength needed to support vehicular traffic. Providing suitable base and subbase material helps to prevent the damage to roads and streets resulting from low strength and frost action.

Capability subclass IIe; woodland suitability subclass 2o.

AnC—Amery silt loam, 6 to 12 percent slopes. This rolling, well drained soil is on convex ridgetops or side slopes on glacial moraines. Individual areas are irregular in shape and generally are 5 to 25 acres in size. Slopes are short and uneven, and shallow depressions are common. In most areas scattered stones are on the surface.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is brown and dark brown silt loam about 10 inches thick. The next 15 inches is a mixture of the subsoil and the subsurface layer. The subsoil is reddish brown and yellowish red sandy loam about 10 inches thick. It has projections of brown sandy loam from the subsurface layer. The underlying material to a depth of about 60 inches is reddish brown and yellowish red sandy loam. In some areas the upper part of the subsoil is silt loam or loam. In places the surface layer is loam. In cultivated areas, which commonly are moderately eroded, plowing has mixed most or all of the subsurface layer with the surface layer.

Included with this soil in mapping are small areas of Freeon and Magnor soils. The moderately well drained Freeon soils are in concave areas where the silty mantle is somewhat thicker. The somewhat poorly drained Magnor soils are in concave areas and shallow depressions. Also included are small areas of a soil that is underlain by sand and gravel, areas where the slope is more than 12 percent, and a few small areas where it is less than 6 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is moderate. Runoff is moderate in cultivated areas. Organic-matter content is moderate. Root penetration is somewhat restricted by compact glacial till below a depth of about 30 inches. Tilth is good, but the soil tends to crust or puddle after heavy rains.

Many areas remain wooded. Some are farmed. The potential is good for pasture and woodland and fair for cultivated crops and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is moderate. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations, minimum tillage, and winter cover crops in combination with spring plowing help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. As a result of the moderate available water capacity, crop yields are limited during dry periods.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is moderately suited to septic tank absorption fields. In some areas it is too slowly permeable, but increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome this limitation.

The slope limits this soil as a site for dwellings, but this limitation can be overcome by land shaping or avoided by constructing buildings in the less sloping included areas. The soil lacks the strength needed to support vehicular traffic. Providing suitable base and subbase material helps to prevent the damage to roads and streets resulting from low strength and frost action.

Capability subclass IIIe; woodland suitability subclass 2o.

AoB—Amery complex, 1 to 6 percent slopes. This map unit consists of nearly level and undulating, somewhat excessively drained, well drained, and moderately well drained soils formed in mixed glacial drift on pitted glacial moraines. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 10 to 60 acres in size. They are 55 to 65 percent Amery soils and 15 to 25 percent Alban, Brill, Campia, Cromwell, Freeon, and Rosholt soils. The soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Amery soil has a surface layer of very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown and dark brown sandy loam about 15 inches thick. The next 16 inches is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand and sandy loam about 9 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand. In places the surface layer is loam or silt loam. In some areas the subsurface layer and part of the subsoil are loam or silt loam.

The Alban, Campia, and Rosholt soils are well drained, the Cromwell soils somewhat excessively drained, and the Brill and Freeon soils moderately well drained. The Alban soils formed in loamy material over glacial lacustrine sediments, the Brill soils in silty material over glacial outwash sediments, the Campia soils in silty material over glacial lacustrine sediments, the Cromwell and Rosholt soils in loamy material over glacial outwash sediments, and the Freeon soils in silty material over loamy glacial till.

Included in this unit in mapping are small areas of the somewhat poorly drained Magnor, Mora, and Poskin soils on concave slopes and in shallow depressions and small areas of the very poorly drained Adolph, Rifle, and Seelyeville soils in deep depressions. Also included are a few areas where the slope is more than 6 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate or moderately slow in the Amery soil and moderately slow to very rapid in the Alban, Brill, Campia, Cromwell, Freeon, and Rosholt soils. Available water capacity is moderate in the Amery soil and very high to low in the other soils. Root penetration is somewhat restricted by compact glacial till below a depth of about 30 inches in the Amery and Freeon soils. Cromwell soils are droughty.

Most areas are woodland. Some are used for cultivated crops or pasture. The potential is fair for cultivated crops, good for pasture and woodland, and poor for most engineering uses.

These soils are suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is moderate. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations help to prevent excessive erosion. Minimum tillage and winter cover crops in combination with spring plowing help to prevent excessive soil loss in row cropped areas. Because some of the soils are droughty, some crops mature unevenly. Wet depressions interfere with cultivation. Draining these depressions generally is difficult. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

These soils are suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because this map unit is complex, onsite investigation is needed to select suitable areas large enough for septic tank absoption fields and for building site development. Most of the soils lack the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation. Adding suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IIe; woodland suitability subclass 2o.

AoC—Amery complex, 6 to 12 percent slopes. This map unit consists of rolling, somewhat excessively drained and well drained soils formed in mixed glacial drift on pitted glacial moraines. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 10 to 60 acres in size. They are 45 to 55 percent Amery soils and 25 to 35 percent Alban, Campia, Cromwell, Menahga, and Rosholt soils. These soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Amery soil has a surface layer of very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown and dark brown sandy loam about 16 inches thick. The next 16 inches is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand and sandy loam about 9 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand. In places the surface layer is loam or silt loam. In some areas the subsurface layer and part of the subsoil are loam or silt loam.

The Alban, Campia, and Rosholt soils are well drained and the Cromwell and Menahga soils somewhat excessively drained. The Alban soils formed in loamy material over glacial lacustrine sediments, the Campia soils in silty material over glacial lacustrine sediments, the Cromwell and Rosholt soils in loamy material over glacial outwash sediments, and the Menahga soils in sandy glacial outwash.

Included in this unit in mapping are small areas of the somewhat poorly drained Magnor, Mora, and Poskin soils on concave slopes and in shallow depressions and small areas of the very poorly drained Adolph, Rifle, and Seelyeville soils in deep depressions. Also included are a few areas where the slope is more than 12 percent and small areas where it is less than 6 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate or moderately slow in the Amery soil and moderate to very rapid in the Alban, Campia, Cromwell, Menahga, and Rosholt soils. Available water capacity is moderate in the Amery soil and very high to low in the other soils. Root penetration is somewhat restricted by compact glacial till below a depth of about 30 inches in the Amery soil. Cromwell and Menahga soils are droughty.

Most areas are woodland. A few are farmed or pastured. The potential is fair for cultivated crops, good for pasture and woodland, and poor for most engineering uses.

These soils are suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is moderate. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations help to prevent excessive erosion. Minimum tillage and winter cover crops in combination with spring plowing help to prevent excessive soil loss in row cropped areas. Because some of the soils are droughty, some crops mature unevenly. Wet depressions interfere with cultivation. Draining these depressions generally is difficult. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

These soils are suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because this map unit is complex, onsite investigation is needed to select suitable areas large enough for septic tank absorption fields and for building site development. If local roads and streets are built, extensive cutting and filling generally is needed because slopes are rolling and irregular. Most of the soils lack the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation. Adding suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IIIe; woodland suitability subclass 2o.

AoD—Amery complex, 12 to 20 percent slopes. This map unit consists of hilly, somewhat excessively drained and well drained soils formed in mixed glacial drift on pitted glacial moraines. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 10 to 60 acres in size. They are 45 to 55 percent Amery soils and 25 to 35 percent Alban, Campia, Cromwell, Menahga, and Rosholt soils. These soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Amery soil has a surface layer of very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown and dark brown sandy loam about 16 inches thick. The next 16 inches is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand and sandy loam about 9 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand. In places the surface layer is loam or silt loam. In some areas the subsurface layer and part of the subsoil are loam or silt loam. In cultivated areas, which commonly are eroded, plowing has mixed most or all of the subsurface layer with the surface layer.

The Alban, Campia, and Rosholt soils are well drained and the Cromwell and Menahga soils somewhat excessively drained. The Alban soils formed in loamy material over glacial lacustrine sediments, the Campia soils in silty material over glacial lacustrine sediments, the Cromwell and Rosholt soils in loamy material over glacial outwash sediments, and the Menahga soils in sandy glacial outwash.

Included in this unit in mapping are small areas of the somewhat poorly drained Magnor, Mora, and Poskin soils on concave slopes and in shallow depressions and small areas of the very poorly drained Adolph, Rifle, and Seelyeville soils in deep depressions. Also included are a few areas where the slope is more than 20 percent and small areas where it is less than 12 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate or moderately slow in the Amery soil and moderate to very rapid in the Alban, Campia, Cromwell, Menahga, and Rosholt soils. Available water capacity is moderate in the Amery soil and very high to low in the other soils. Root penetration is somewhat restricted by compact glacial till below a depth of about 30 inches in the Amery soil. Cromwell and Menahga soils are droughty.

Most areas are woodland. A few are farmed or pastured. The potential is good for woodland, fair for pasture, and poor for cultivated crops and most engineering uses.

These soils are poorly suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is severe. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations help to prevent excessive erosion. Minimum tillage and winter cover crops in combination with spring plowing help to prevent excessive soil loss in row cropped areas. Because some of the soils are droughty, some crops mature unevenly. Wet depressions interfere with cultivation. Draining these depressions generally is difficult. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

These soils are suited to growing many of the pasture grasses and legumes. Overgrazing, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotation help to keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The soil related forest management problems are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Care in planting and selection of vigorous planting stock improve seedling survival on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because this map unit is complex, onsite investigation is needed to select suitable areas large enough for septic tank absorption fields and for building site development. The slope limits these soils as sites for septic tank absorption fields and for dwellings and small commercial buildings, but this limitation can be overcome by land shaping or avoided by selecting the less steep included areas.

If local roads and streets are built on these soils, extensive cutting and filling generally is needed because slopes are hilly and irregular. Most of the soils lack the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation. Adding suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IVe; woodland suitability subclass 2r.

AoE—Amery complex, 20 to 30 percent slopes. This map unit consists of very hilly, somewhat excessively drained and well drained soils formed in mixed glacial drift on pitted glacial moraines. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 10 to 35 acres in size. They are 35 to 45 percent Amery soils and 35 to 45 percent Alban, Campia, Cromwell, Menahga, and Rosholt soils. These soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Amery soil has a surface layer of very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown and dark brown sandy loam about 12 inches thick. The next 14 inches is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand and sandy loam about 7 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand. In places the surface layer is loam or silt loam. In some areas the subsurface layer and part of the subsoil are loam or silt loam.

The Alban, Campia, and Rosholt soils are well drained and the Cromwell and Menahga soils somewhat excessively drained. The Alban soils formed in loamy material over glacial lacustrine sediments, the Campia soils in silty material over glacial lacustrine sediments, the Cromwell and Rosholt soils in loamy material over glacial outwash sediments, and the Menahga soils in sandy glacial outwash.

Included in this unit in mapping are small areas of the somewhat poorly drained Magnor, Mora, and Poskin soils on concave slopes and in shallow depressions, small areas of the very poorly drained Adolph, Rifle, and Seelyeville soils in deep depressions, and a few areas of the excessively drained Emmert soils on small eskers and kames. Also included are a few areas where the slope is more than 30 percent and small areas where it is less than 20 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate or moderately slow in the Amery soil and moderate to very rapid in the Alban, Campia, Cromwell, Menahga, and Rosholt soils. Available water capacity is moderate in the Amery soil and very high to low in the other soils. Root penetration is somewhat restricted by compact glacial till below a depth of 30 inches in the Amery soil. Cromwell and Menahga soils are droughty.

Most areas are woodland. The potential is good for woodland, fair for pasture, and poor for cultivated crops and most engineering uses.

These soils are generally unsuitable for cultivated crops because of the very hilly slopes and a severe hazard of erosion. They are suited to growing many of the pasture grasses and legumes. The use of these soils as pasture or hayland is effective in controlling erosion. The very hilly slopes hinder farm machinery. Bluegrass should be favored in areas that are too steep for machinery and cannot be renovated by chemicals. Overgrazing results in surface compaction, poor tilth, and erosion. Proper stocking rates and pasture rotation keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The soil related forest management problems are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Care in planting and selection of vigorous planting stock improve seedling survival on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because this map unit is complex, onsite investigation is needed to select suitable areas large enough for septic tank absorption fields and building site development. These soils are poorly suited as sites for septic tank absorption fields and for dwellings and small commercial buildings because they are very hilly. This limitation can be overcome, however, by extensive land shaping or avoided by selecting the less steep included areas.

If local roads and streets are built on these soils, extensive cutting and filling generally is needed because slopes are very hilly and irregular. Most of the soils lack the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation. Adding suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass VIe; woodland suitability subclass 2r.

ArC—Amery-Rock outcrop complex, 2 to 12 percent slopes. This map unit consists of an undulating and rolling, well drained Amery soil and Rock outcrop on glacial moraines. Individual areas are oval and generally are 5 to 30 acres in size. They are 50 to 60 percent Amery soil and 15 to 35 percent Rock outcrop (fig. 6). The rock outcrops are gabbro and diabase and basic igneous rocks locally known as traprock. The Amery soil and Rock outcrop are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Amery soil has a surface layer of very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown and dark brown sandy loam about 16 inches thick. The next 16 inches is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand and sandy loam about 9 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand. In some areas the surface layer is loam or silt loam. In places the subsurface layer and part of the subsoil are loam or silt loam.

Included with this unit in mapping are small areas of Rosholt soils, which have very rapidly permeable underlying material; small areas of the moderately well drained Freeon soils and somewhat poorly drained Magnor and Mora soils on concave slopes or in shallow depressions; and areas where bedrock is within 40 inches of the surface. Also included are a few areas where slopes are short and more than 12 percent. Included areas make up 5 to 15 percent of the unit.

The Amery soil is moderately or moderately slowly permeable and has a moderate available water capacity. Root penetration is somewhat restricted by compact glacial till below a depth of about 30 inches in the Amery soil. The Rock outcrop is very hard and generally impermeable.

Most areas are woodland or pasture. The potential is good for woodland, fair for pasture, and poor for cultivated crops and most engineering uses.

This map unit is generally unsuited to growing corn and small grain and to grasses and legumes for forage because the Rock outcrop hinders farm machinery. It is suited to a limited number of pasture grasses and legumes. Yields are low because of the extensive areas of Rock outcrop. Bluegrass should be favored in areas where Rock outcrop prohibits the use of farm machinery and renovation by chemicals is not feasible.

This map unit is poorly suited to trees used for wood products. Trees grow well on the Amery soil, but the Rock outcrop hinders machinery. Planting by hand and on the contour and carefully locating access roads help to offset trafficability problems and control erosion.

The Amery soil is moderately well suited as a site for septic tank absorption fields. In some areas it is too slowly permeable, but increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome this limitation. Onsite investigation is needed to identify the unsuitable areas of Rock outcrop and the included areas where the soils are shallow to rock or are too poorly drained. This unit is poorly suited as a site for buildings and local roads and streets because of the Rock outcrop. It is a source of crushed rock for construction and road building.

Capability subclass VIs; Amery soil in woodland suitability subclass 2o, Rock outcrop not assigned to a woodland suitability subclass.

ArD—Amery-Rock outcrop complex, 12 to 45 percent slopes. This map unit consists of a hilly to very steep, well drained Amery soil and Rock outcrop on bedrock ridges. Individual areas are oval and generally are 3 to 30 acres in size. They are 30 to 40 percent Amery soil and 35 to 60 percent Rock outcrop (fig. 7). The rock outcrops are gabbro and diabase and basic igneous rocks locally known as traprock. The Amery soil is on the tops and concave sides of ridges, and the Rock outcrop is on convex side slopes. The Amery soil and Rock outcrop are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Amery soil has a surface layer of very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is brown and dark brown sandy loam about 12 inches thick. The next 14 inches is multicolored sandy loam. The subsoil is reddish brown and yellowish red loamy sand and sandy loam about 7 inches thick. The underlying material to a depth of about 60 inches is reddish brown and yellowish red loamy sand. In places the surface layer is loam or silt loam. In some areas the subsurface layer and part of the subsoil are loam or silt loam.

Included with this unit in mapping are small areas of the somewhat excessively drained Chetek and Cromwell soils, small areas of the somewhat poorly drained Magnor and Mora soils in shallow depressions, and areas where bedrock is within 40 inches of the surface. Also included are a few areas where the slope is less than 12 percent. Included areas make up 5 to 15 percent of the unit.

The Amery soil is moderately or moderately slowly permeable and has a moderate available water capacity. Root penetration is somewhat restricted by compact glacial till below a depth of about 30 inches in the Amery soil. The Rock outcrop is very hard and generally impermeable.

Most areas are wooded. This map unit is generally unsuitable for cultivated crops, pasture, and most engineering uses because of the Rock outcrop and the hilly to very steep slopes. The Amery soil is suited to woodland. The Rock outcrop is a source of crushed rock for construction and road building.

Capability subclass VIIs; Amery soil in woodland suitability subclass 2r, Rock outcrop not assigned to a woodland suitability subclass.

AtA—Antigo silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad glacial outwash plains and stream terraces. Individual areas are irregular in shape and generally are 10 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 14 inches thick. It is dark yellowish brown silt loam over dark brown loam. The underlying material to a depth of about 60 inches is dark brown and reddish brown, stratified sand and gravel. In places, the silty mantle is thinner and depth to the underlying material is less than 34 inches. In some areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few small areas of the moderately well drained Brill and somewhat poorly drained Poskin soils on concave slopes or in shallow depressions. Also included are small areas where the slope is more than 2 percent and areas where, as a result of loamy bands in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 2 to 10 percent of the unit.

Permeability is moderate in the upper silty material and very rapid in the underlying material. Available water capacity is moderate. Organic-matter content also is moderate, and tilth is good.

Most areas are farmed. Only a few areas are pasture or woodland. The potential is good for cultivated crops, pasture, woodland, and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. As a result of the moderate available water capacity, crop yields are limited during dry periods.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

Although little of the acreage is woodland, this soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because the underlying material is very rapidly permeable. The soil is moderately well suited as a site for dwellings and local roads and streets. Providing suitable base material avoids the problems resulting from the shrinking and swelling, low strength, and frost action in this soil.

Capability subclass IIs; woodland suitability subclass 2o.

AtB—Antigo silt loam, 2 to 6 percent slopes. This undulating, well drained soil is on broad glacial outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 14 inches thick. It is dark yellowish brown silt loam over dark brown loam. The underlying material to a depth of about 60 inches is dark brown and reddish brown, stratified coarse sand and gravel. In places, the silty mantle is thinner and depth to the underlying material is less than 34 inches. In some areas the underlying material contains little or no gravel. In places plowing has mixed the subsurface layer with the surface layer.

Included with this soil in mapping are a few small areas of the moderately well drained Brill and somewhat poorly drained Poskin soils on concave slopes or in shallow depressions. Also included are a few areas where slopes are short and more than 6 percent and areas where, as a result of loamy bands in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 2 to 15 percent of the unit.

Permeability is moderate in the upper silty material and very rapid in the underlying material. Available water capacity is moderate. Organic-matter content also is moderate, and tilth is good.

Most areas are farmed. A few are pasture or woodland. The potential is good for cultivated crops, pasture, woodland, and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. In most areas row crops can be grown year after year without excessive soil loss if tillage is kept to a minimum. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. As a result of the moderate available water capacity, crop yields are limited during dry periods.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or mechanical removal of the brush.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because the underlying material is very rapidly permeable. The soil is moderately well suited as a site for dwellings and local roads and streets. Providing suitable base material avoids the problems resulting from the shrinking and swelling, low strength, and frost action in this soil.

Capability subclass IIe; woodland suitability subclass 2o.

AtC2—Antigo silt loam, 6 to 12 percent slopes, eroded. This rolling, well drained soil is on glacial outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The next 6 inches is a mixture of the subsoil and the surface layer. The subsoil is about 14 inches thick. It is dark yellowish brown silt loam over dark brown loam. The underlying material to a depth of about 60 inches is dark brown and reddish brown, stratified coarse sand and gravel. In uncultivated areas the surface layer overlies a subsurface layer of brown silt loam about 4 inches thick. In some areas the surface layer is loam or very fine sandy loam. In some places, the silty mantle is thinner and depth to the underlying material is less than 28 inches. In other places the underlying material contains little or no gravel.

Included with this soil in mapping are a few small areas of the moderately well drained Brill and somewhat poorly drained Poskin soils in shallow depressions, small areas of the somewhat excessively drained Chetek soils on convex slopes, a few areas where slopes are short and more than 12 percent, and some areas where they are less than 6 percent. Also included are some areas where, as a result of loamy bands in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the upper silty material and very rapid in the underlying material. Available water capacity is moderate. Surface runoff is medium in cultivated areas. Organic-matter content is low. Erosion has lowered the organic-matter content and the fertility level, decreased the capacity of the soil to retain water, and resulted in poorer tilth in the surface layer.

Most areas are farmed. A few are pasture or woodland. The potential is good for cultivated crops, pasture, woodland, and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of further erosion is moderate. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. Minimum tillage, winter cover crops, and spring plowing help to reduce soil losses in row cropped areas. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility and increases the rate of water infiltration. As a result of the moderate available water capacity, crop yields are limited during dry periods.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is moderately suited to septic tank absorption fields. The effluent can pollute ground water, however, because the underlying material is very rapidly permeable. The soil is moderately well suited as a site for dwellings and local roads and streets. Providing suitable base material avoids the problems resulting from the shrinking and swelling, low strength, and frost action in this soil. Because of the slope, land shaping is needed on some building sites. The less sloping included areas are better building sites.

Capability subclass IIIe; woodland suitability subclass 2o.

AuA—Auburndale silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, poorly drained soil is in concave areas and broad drainageways on glacial moraines. It is subject to frequent flooding. Most areas are long and narrow and are 5 to 20 acres in size.

Typically, the surface layer is black silt loam about 4 inches thick. The subsurface layer is light brownish gray, mottled silt about 9 inches thick. The next 5 inches is multicolored silt loam that has tongues of silt. The subsoil is grayish brown and light brownish gray, mottled silt loam about 13 inches thick. The underlying material to a depth of about 60 inches is light gray, mottled silt. In places the underlying material is sandy loam or has strata of loamy sand or sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Magnor soils on convex slopes or in slightly higher positions and a few areas of the poorly drained and very poorly drained Adolph soils in small depressions. Also included are small areas where the slope is more than 3 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderately slow, and available water capacity is very high. Organic-matter content is moderate, and tilth is good. This soil receives runoff from adjacent slopes and is likely to be ponded for brief periods after heavy rains. It is saturated within a foot of the surface during wet periods unless it is drained.

Most areas are farmed. The potential is good for cultivated crops and pasture, fair for woodland, and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches, land smoothing or subsurface drainage, and diversions controls ponding and results in more dependable crop production. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

If adequately drained, this soil is suited to growing many of the pasture grasses and legumes. In undrained areas a high water table restricts the suitable pasture plants to such species as bluegrass and reed canarygrass. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Because the soil is wet, trees generally should be planted on prepared ridges if natural regeneration is unreliable. Selection of large, vigorous nursery stock helps to avoid a high mortality rate. Harvest is frequently limited to periods when the ground is frozen. Clear-cut or group-selection harvest methods reduce the danger of windthrow to the remaining trees. Suitable herbicides or mechanical removal controls competing vegetation and thus permits natural regeneration.

Because of the seasonal high water table and the flooding, this soil is generally unsuited to septic tank absorption fields. Artificial drainage and protection from ponding are needed if the soil is used as a site for dwellings, small commercial buildings, or local roads and streets. This soil lacks the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation. Adding suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IIIw; woodland suitability subclass 3w.

Ba—Barronett silt loam. This nearly level, poorly drained soil is on broad glacial lake plains and terraces. It is subject to occasional flooding. Individual areas are irregular in shape and generally are 5 to 50 acres in size.

Typically, the surface layer is black silt loam about 9 inches thick. The subsurface layer is light gray, mottled silt loam about 7 inches thick. The subsoil is light gray, mottled silt loam about 18 inches thick. The underlying material to a depth of about 60 inches is light brownish gray, mottled, stratified silt and very fine sand. In places the surface layer and part of the subsoil are fine sandy loam or very fine sandy loam.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Comstock soils on convex slopes or in slightly higher positions, a few small areas where the surface layer is muck, and a few areas of the very poorly drained Cathro soils in shallow depressions and narrow drainageways. Also included are a few areas where the slope is more than 2 percent. Included areas make up 2 to 7 percent of the unit.

Permeability is moderately slow, and available water capacity is very high. Organic-matter content is high, and tilth is good. In some areas this soil receives runoff from adjacent slopes and is likely to be ponded for brief periods after heavy rains. It is saturated within a foot of the surface during wet periods unless it is drained.

Most areas are farmed. The potential is good for cultivated crops and pasture and poor for woodland and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches, land smoothing or subsurface drainage, and diversions controls ponding and results in more dependable crop production. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

If adequately drained, this soil is suited to growing many of the pasture grasses and legumes. In undrained areas a seasonal high water table restricts the suitable pasture plants to such species as bluegrass and reed canarygrass. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is poorly suited to woodland. Trees grow slowly and have poor form. Because the soil is wet, they generally should be planted on prepared ridges if natural regeneration is unreliable. Selection of large, vigorous nursery stock helps to avoid a high mortality rate. Harvest is frequently limited to periods when the ground is frozen. Clear-cut or group-selection harvest methods reduce the danger of windthrow to the remaining trees. Suitable herbicides or mechanical removal controls competing vegetation and thus permits natural regeneration.

Because of the seasonal high water table and the ponding, this soil is generally unsuited to septic tank absorption fields. Artificial drainage and protection from ponding are needed if the soil is used as a site for dwellings, small commercial buildings, or local roads and streets. The soil lacks the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation. Adding suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IIIw; woodland suitability subclass 5w.

Be—Barronett Variant fine sandy loam. This nearly level, poorly drained soil is on broad glacial lake plains and terraces. It is subject to occasional flooding. Individual areas are irregular in shape and generally are 5 to 40 acres in size.

Typically, the surface layer is black, mottled fine sandy loam about 12 inches thick. The subsoil is about 19 inches thick. It is light gray, mottled loamy fine sand in the upper part; gray, mottled silt loam in the middle part; and light gray coarse silt in the lower part. The underlying material to a depth of about 60 inches is light gray, strong brown, and light reddish brown, mottled, stratified silt, silty clay, and fine sand. In places the surface layer is sandy loam, loam, or silt loam. In some areas the underlying material has strata of sand or coarse sand.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Comstock and Plover soils, a few small areas where the surface layer is muck, and a few areas of the very poorly drained Cathro soils in shallow depressions and narrow drainageways. Also included are small areas where the slope is more than 2 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderate, and available water capacity is high. Organic-matter content also is high, and tilth is good. In some areas this soil receives runoff from adjacent slopes and is occasionally ponded for brief periods after heavy rains. It is saturated within a foot of the surface during wet periods unless it is drained.

Many areas are farmed. The potential is good for cultivated crops and pasture and poor for woodland and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches or land smoothing and diversions controls ponding and results in more dependable crop production. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

If adequately drained, this soil is suited to growing many of the pasture grasses and legumes. In undrained areas a seasonal high water table restricts the suitable pasture plants to such species as bluegrass and reed canarygrass. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is poorly suited to woodland. Trees grow slowly and have poor form. Because the soil is wet, they generally should be planted on prepared ridges if natural regeneration is unreliable. Selection of large, vigorous nursery stock helps to avoid a high mortality rate. Harvest is frequently limited to periods when the ground is frozen. Clear-cut or group-selection harvest methods reduce the danger of windthrow to the remaining trees. Suitable herbicides or mechanical removal controls competing vegetation and thus permits natural regeneration.

Because of the seasonal high water table and the ponding, this soil is generally unsuited to septic tank absorption fields. Artificial drainage and protection from ponding are needed if the soil is used as a site for dwellings, small commercial buildings, or local roads and streets. Providing suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IIIw; woodland suitability subclass 5w.

Bf—Bluffton loam. This nearly level, poorly drained and very poorly drained soil is in depressional areas and drainageways on glacial moraines. It is subject to frequent flooding. Individual areas are irregularly shaped or long and narrow and generally are 3 to 15 acres in size.

Typically, the surface layer is very dark grayish brown and very dark gray, mottled loam about 10 inches thick. The subsoil is gray and light brownish gray, mottled loam about 16 inches thick. The underlying material to a depth of about 60 inches is gray, mottled loam. In places the surface layer is fine sandy loam or silt loam. In some areas the underlying material has strata of loamy sand or sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Alstad soils on convex slopes or in slightly higher positions, small areas where the surface layer is muck, and small areas of the very poorly drained Cathro soils in shallow depressions. Also included are small areas where the slope is more than 2 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is high. Organic-matter content is high, and tilth is good. This soil receives runoff from adjacent slopes and is frequently ponded for brief periods after heavy rains. It is saturated within 1 foot of the surface during wet periods unless it is drained.

Most areas are farmed. The potential is good for cultivated crops and pasture, fair for woodland, and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches, land smoothing, and diversions controls ponding and results in more dependable crop production. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

If adequately drained, this soil is suited to growing many of the pasture grasses and legumes. In undrained areas a seasonal high water table restricts the suitable pasture plants to such species as bluegrass and reed canarygrass. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Because the soil is wet, trees generally should be planted on prepared ridges if natural regeneration is unreliable. Selection of large, vigorous nursery stock helps to avoid a high mortality rate. Harvest is frequently limited to periods when the ground is frozen. Clear-cut or group-selection harvest methods reduce the danger of windthrow to the remaining trees. Suitable herbicides or mechanical removal controls competing vegetation and thus permits natural regeneration.

Because of the seasonal high water table and the ponding, this soil is generally unsuited to septic tank absorption fields. Artificial drainage and protection from ponding are needed if the soil is used as a site for dwellings, small commerical buildings, or local roads and streets. Providing suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IIIw; woodland suitability subclass 3w.

BlA—Brill silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, moderately well drained soil is on broad outwash plains and stream terraces. Individual areas are irregular in shape and generally are 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsurface layer is brown silt loam about 7 inches thick. The next 10 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 15 inches thick. It is yellowish brown, mottled silt loam over strong brown sandy loam. The underlying material to a depth of about 60 inches is reddish yellow, stratified sand and gravel. In places the surface layer and upper part of the subsoil are loam or sandy loam. In a few areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few small areas of the well drained Antigo and Rosholt soils on concave slopes, a few areas of the somewhat poorly drained Poskin soils in shallow depressions, and a few areas where, as a result of bands of loamy or silty material in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where the slope is more than 3 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate in the upper silty material and very rapid in the underlying material. Available water capacity is moderate, and runoff is slow in cultivated areas. Organic-matter content is moderate, and tilth is good. This soil is saturated within 3 to 5 feet of the surface during wet periods.

Most areas are farmed. Only a few areas are pasture or woodland. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

Although little of the acreage is woodland, this soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is poorly suited to septic tank absorption fields because it has a seasonal high water table. A filtering mound of suitable material, however, improves these absorption fields. Building sites should be artificially drained if dwellings with basements are constructed. Providing suitable base material helps to prevent the damage to dwellings and small commercial buildings caused by shrinking and swelling. Adding suitable subbase material helps to prevent the damage to local roads and streets caused by frost action.

Capability subclass IIs; woodland suitability subclass 2o.

BpA—Burkhardt sandy loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 25 acres in size.

Typically, the surface layer is very dark brown sandy loam about 11 inches thick. The subsoil is about 13 inches thick. It is dark brown sandy loam over brown loamy coarse sand. The underlying material to a depth of about 60 inches is yellowish brown, stratified coarse sand and gravel. In places the surface layer is loam. In some areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few areas of the well drained Dakota soils, a few small areas of the somewhat poorly drained Dakota Variant in shallow depressions or narrow drainageways, and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few scattered areas where limestone bedrock is within 60 inches of the surface and small areas where the slope is more than 2 percent. Included areas make up 2 to 15 percent of the unit.

Permeability is moderately rapid in the upper loamy material and rapid in the underlying material. Available water capacity is low. Runoff is very slow in cultivated areas. Organic-matter content is moderate, and tilth is good.

Most areas are farmed. Some are pastured. This soil is not naturally forested and generally is not managed as woodland. The potential is fair for cultivated crops and pasture and good for most engineering uses.

This soil is suited to growing corn, soybeans, and small grain and to grasses and legumes for forage. It is droughty, however, and crop yields in most years are limited as a result of the low available water capacity. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can cause surface compaction and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because the underlying material is rapidly permeable. The soil is also suited to building site development. It is a source of sand and gravel. Gravel pits are in some areas.

Capability subclass IIIs; not assigned to a woodland suitability subclass.

BpB—Burkhardt sandy loam, 2 to 6 percent slopes. This undulating, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 25 acres in size.

Typically, the surface layer is very dark brown sandy loam about 11 inches thick. The subsoil is about 13 inches thick. It is dark brown sandy loam over brown loamy coarse sand. The underlying material to a depth of about 60 inches is brown, stratified coarse sand and gravel. In places the surface layer is loam. In some areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few areas of the well drained Dakota soils, a few small areas of the somewhat poorly drained Dakota Variant in shallow depressions or narrow drainageways, and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few scattered areas where limestone bedrock is within 60 inches of the surface, a few areas where slopes are short and more than 6 percent, and a few where they are less than 2 percent. Included areas make up 2 to 15 percent of the unit.

Permeability is moderately rapid in the upper loamy material and rapid in the underlying material. Available water capacity is low. Runoff is slow in cultivated areas. Organic-matter content is moderate, and tilth is good.

Most areas are farmed. Some are pastured. This soil is not naturally forested and generally is not managed as woodland. The potential is fair for cultivated crops and pasture and good for most engineering uses.

This soil is suited to growing corn, soybeans, and small grain and to grasses and legumes for forage. It is droughty, however, and crop yields in most years are limited as a result of the low available water capacity. Proper crop rotations and minimum tillage help to prevent excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because the underlying material is rapidly permeable. The soil is also suited to building site development. It is a source of sand and gravel. Gravel pits are in some areas.

Capability subclass IIIe; not assigned to a woodland suitability subclass.

BpC2—Burkhardt sandy loam, 6 to 12 percent slopes, eroded. This sloping, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are long and narrow and generally are 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 9 inches thick. The subsoil is about 11 inches thick. It is dark brown sandy loam over brown loamy coarse sand. The underlying material to a depth of about 60 inches is brown, stratified coarse sand and gravel. In places the surface layer is loam. In some areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few areas of the well drained Dakota soils, a few small areas of the somewhat poorly drained Dakota Variant in shallow depressions or narrow drainageways, and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and the available water capacity is higher. Also included are a few scattered areas where limestone bedrock is within 60 inches of the surface, a few areas where the slope is more than 12 percent, and small areas where it is less than 6 percent. Included areas make up 2 to 15 percent of the unit.

Permeability is moderately rapid in the upper loamy material and rapid in the underlying material. Available water capacity is low. Runoff is medium in cultivated areas. Erosion has lowered the organic-matter content and the fertility level, decreased the capacity of the soil to retain water, and resulted in poor tilth in the surface layer.

Most areas are farmed. Some are pastured. This soil is not naturally forested and generally is not managed as woodland. The potential is fair for cultivated crops, pasture, and most engineering uses.

This soil is suited to growing corn, soybeans, and small grain and to grasses and legumes for forage. It is droughty, however, and crop yields in most years are limited as a result of the low available water capacity. If cultivated crops are grown, the hazard of further erosion is moderate. A proper crop rotation helps to prevent excessive soil loss. Minimum tillage, winter cover crops, and spring plowing help to reduce soil losses in row cropped areas. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is moderately suited to septic tank absorption fields. The effluent can pollute ground water because the underlying material is rapidly permeable. Because of the slope, land shaping is needed on some building sites and cutting and filling are needed on most sites for local roads and streets. The less sloping included areas are better building sites. Stabilizing road cuts is difficult because cutbanks cave in and are low in natural fertility. Land shaping and additions of suitable topsoil, however, can overcome these limitations. This soil is a source of sand and gravel. Gravel pits are in some areas.

Capability subclass IVe; not assigned to a woodland suitability subclass.

CaA—Campia silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad glacial lake plains. Individual areas are irregular in shape and generally are 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The next 13 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark brown silt loam about 15 inches thick. The underlying material to a depth of about 60 inches is dark yellowish brown, mottled silt. In places the surface layer is loam or very fine sandy loam. In a few areas the subsoil is fine sandy loam or is redder.

Included with this soil in mapping are a few small areas of the moderately well drained Crystal Lake and somewhat poorly drained Comstock soils on concave slopes. Also included are small areas where the slope is more than 2 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderate, and available water capacity is very high. Organic-matter content is moderate, and tilth is good.

Most areas are farmed. Only a few areas are pasture or woodland. The potential is good for cultivated crops, pasture, and woodland and fair for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

Although little of the acreage is woodland, this soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is suited to septic tank absorption fields. It lacks the strength needed to support vehicular traffic and dwellings and small commercial buildings, but strengthening or replacing the base material can overcome this limitation. Providing suitable subbase material helps to prevent the road damage caused by frost action.

Capability class I; woodland suitability subclass 2o.

CaB—Campia silt loam, 2 to 6 percent slopes. This undulating, well drained soil is on broad glacial lake plains and terraces. Individual areas are irregular in shape and generally are 10 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The next 13 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark brown silt loam about 15 inches thick. The underlying material to a depth of about 60 inches is dark yellowish brown, mottled silt. In places the surface layer is loam or very fine sandy loam. In a few areas the subsoil is fine sandy loam or is redder.

Included with this soil in mapping are a few small areas of the moderately well drained Crystal Lake and somewhat poorly drained Comstock soils on concave slopes and in shallow depressions. Also included are areas where slopes are short and more than 6 percent and small areas where they are less than 2 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderate, and available water capacity is very high. Runoff is slow. Organic-matter content is moderate, and tilth is good.

Most areas are farmed. Only a few areas are pasture or woodland. The potential is good for cultivated crops, pasture, and woodland and fair for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. In most areas row crops can be grown year after year without excessive soil loss if tillage is kept to a minimum. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep pasture and the soil in good condition.

Although little of the acreage is woodland, this soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is suited to septic tank absorption fields. It lacks the strength needed to support vehicular traffic and dwellings and small commercial buildings, but strengthening or replacing the base material can overcome this limitation. Providing suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IIe; woodland suitability subclass 2o.

CaC2—Campia silt loam, 6 to 12 percent slopes, eroded. This rolling, well drained soil is on glacial lake plains and terraces. Individual areas are long and narrow and generally are 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The next 10 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark brown silt loam about 15 inches thick. The underlying material to a depth of about 60 inches is dark yellowish brown silt. In uncultivated areas the surface layer overlies a brown silt loam subsurface layer about 3 inches thick. In places the surface layer is loam or very fine sandy loam. In a few areas the subsoil is fine sandy loam or is redder.

Included with this soil in mapping are a few small areas of the moderately well drained Crystal Lake and somewhat poorly drained Comstock soils on concave slopes and in shallow depressions. Also included are areas where slopes are short and more than 12 percent and small areas where they are less than 6 percent. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate, and available water capacity is very high. Surface runoff is medium. Organic-matter content is low. Erosion has lowered the organic-matter content and the fertility level, decreased the capacity of the soil to retain water, and resulted in poorer tilth in the surface layer.

Most areas are farmed. Only a few areas are pasture or woodland. The potential is good for cultivated crops, pasture, and woodland and fair for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of further erosion is moderate. In many areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation can prevent excessive soil loss. Minimum tillage, winter cover crops, and spring plowing reduce soil losses in row cropped areas. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

Although little of the acreage is woodland, this soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is suited to septic tank absorption fields. It lacks the strength needed to support vehicular traffic and dwellings and small commercial buildings, but strengthening or replacing the base material can overcome this limitation. Providing suitable subbase material helps to prevent the road damage caused by frost action. Because of the slope, land shaping is needed on some building sites. The less sloping included areas are better building sites.

Capability subclass IIIe; woodland suitability subclass 2o.

CbB—Campia Variant loam, 2 to 6 percent slopes. This undulating, well drained and moderately well drained soil is on glacial lake plains and terraces. Individual areas are irregular in shape and generally are 5 to 15 acres in size.

Typically, the surface layer is dark brown loam about 6 inches thick. The subsurface layer is yellowish brown loam about 3 inches thick. The next 5 inches is a mixture of the subsoil and the subsurface layer. The subsoil is brown and yellowish brown silty clay about 18 inches thick. The underlying material to a depth of about 60 inches is brown and reddish brown, mottled, stratified clay, silty clay, silt, and fine sand. In places the surface layer is fine sandy loam or silt loam. In some areas the upper part of the subsoil is loam or sandy loam.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Comstock Variant on concave slopes and in shallow depressions and small areas of Alban and Rosholt soils, which are more rapidly permeable than the Campia Variant. Also included are areas where slopes are short and more than 6 percent and small areas where they are less than 2 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is moderate. Runoff is medium in cultivated areas. Organic-matter content is moderate, and tilth is good. The shrink-swell potential is moderate. In some areas this soil is saturated within a depth of 3 feet during wet periods.

Many areas are farmed, and many remain wooded or are pastured. The potential is good for cultivated crops, woodland, and pasture and fair or poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to control erosion. Minimum tillage, winter cover crops, and spring plowing help to prevent excessive soil loss in row cropped areas. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because it is too slowly permeable and in some areas has a seasonal high water table too near the surface, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material improves these absorption fields. On sites for dwellings and small commercial buildings, suitable base material is needed to avoid the damage caused by low strength and shrinking and swelling. Artificial drainage is needed in some areas if buildings with basements are constructed. This soil lacks the strength needed to support vehicular traffic, but replacing the base material can overcome this limitation.

Capability subclass IIe; woodland suitability subclass 2o.

CbC—Campia Variant loam, 6 to 12 percent slopes. This rolling, well drained soil is on glacial lake plains and terraces. Individual areas are irregular in shape and generally are 5 to 15 acres in size.

Typically, the surface layer is dark brown loam about 6 inches thick. The subsurface layer is yellowish brown loam about 1 inch thick. The next 4 inches is a mixture of the subsoil and the subsurface layer. The subsoil is brown and yellowish brown silty clay about 18 inches thick. The underlying material to a depth of about 60 inches is brown and reddish brown, mottled, stratified clay, silty clay, silt, and fine sand. In places the surface layer is fine sandy loam or silt loam. In some areas the upper part of the subsoil is loam or sandy loam.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Comstock Variant on concave slopes and in shallow depressions and small areas of Alban and Rosholt soils, which are more rapidly permeable than the Campia Variant. Also included are areas where slopes are short and more than 12 percent and small areas where they are less than 6 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is moderate. Runoff is medium in cultivated areas. Organic-matter content is moderate, and tilth is good. The shrink-swell potential is moderate.

Many areas are farmed, and many remain wooded or are pastured. The potential is good for cultivated crops, woodland, and pasture and fair to poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to control erosion. Minimum tillage, winter cover crops, and spring plowing help to prevent excessive soil loss in row cropped areas. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because it is too slowly permeable, this soil is poorly suited to septic tank absorption fields. Building a filtering mound of suitable material and increasing the size of the absorption field are beneficial.

On sites for dwellings and small commercial buildings, suitable base material is needed to avoid the damage caused by low strength and shrinking and swelling. Because of the slope, land shaping is needed on some building sites. The less sloping included areas are better building sites. This soil lacks the strength needed to support vehicular traffic, but replacing the base material can overcome this limitation. Extensive cutting and filling generally is needed if local roads and streets are built on this soil.

Capability subclass IIIe; woodland suitability subclass 2o.

CbD—Campia Variant loam, 12 to 20 percent slopes. This hilly and moderately steep, well drained soil is on glacial lake plains and terraces. Individual areas are long and narrow and generally are 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is yellowish brown loam about 6 inches thick. The next 5 inches is a mixture of the subsoil and the subsurface layer. The subsoil is brown and yellowish brown silty clay about 15 inches thick. The underlying material to a depth of about 60 inches is brown and reddish brown, stratified clay, silty clay, silt, and fine sand. In places the surface layer is fine sandy loam or silt loam. In some areas the upper part of the subsoil is loam or sandy loam. In cultivated areas, which commonly are moderately eroded, plowing has mixed the subsurface layer with the surface layer.

Included with this soil in mapping are a few small areas of the somewhat poorly drained Comstock Variant on concave slopes and the poorly drained Barronett soils in shallow depressions and small areas of Alban and Rosholt soils, which are more rapidly permeable than the Campia Variant. Also included are areas where slopes are short and more than 20 percent and small areas where they are less than 12 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is moderate. Runoff is rapid in cultivated areas. Organic-matter content is moderate, and tilth is good. The shrink-swell potential is moderate.

Most areas are woodland. A few are farmed or pastured. The potential is good for woodland, fair for pasture, and poor for cultivated crops and most engineering uses.

This soil is poorly suited to growing corn and small grain but is suited to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is severe. In many areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to control erosion. Minimum tillage, winter cover crops, and spring plowing help to prevent excessive soil loss in row cropped areas.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The soil related problems of forest management are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Care in planting and selection of vigorous planting stock can improve seedling survival on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because it is too slowly permeable and too steep, this soil is poorly suited to septic tank absorption fields. These absorption fields can be installed in the less steep included areas. A filtering mound of suitable material is needed.

The slope limits this soil as a site for dwellings, but this limitation can be overcome by land shaping or avoided by constructing buildings in the less steep included areas. Providing suitable base material helps to prevent the damage to dwellings and small commercial buildings caused by low strength and shrinking and swelling. Extensive cutting and filling generally is needed on sites for local roads and streets. This soil lacks the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation.

Capability subclass IVe; woodland suitability subclass 2r.

Cc—Cathro muck. This nearly level, very poorly drained soil is in bogs and depressional areas on glacial moraines and lake plains. It is subject to frequent flooding. Individual areas are irregular in shape and generally are 3 to 20 acres in size.

Typically, a 1-inch layer of dark brown moss peat is at the surface. Below this is dark reddish brown and very dark grayish brown muck about 39 inches thick. The underlying material to a depth of about 60 inches is dark gray and greenish gray, mottled, stratified silt and very fine sand. In places thin layers of mucky peat are in the organic part. In some areas the underlying material has strata of sand or loamy sand.

Included with this soil in mapping are small areas of mineral soils on convex knolls; a few areas of Rifle and Seelyeville soils, which have an organic layer more than 51 inches thick; and small areas of the wet Fluvaquents adjacent to streams. Also included are a few areas that are very strongly acid or extremely acid. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the organic layer and moderately slow in the underlying material. This soil is saturated within a foot of the surface most of the year.

Most areas remain in wetland vegetation. The potential is poor for cultivated crops, pasture, and most engineering uses and fair for woodland.

This soil is generally unsuited to growing corn and small grain and to grasses and legumes for forage because of the high water table and the flooding. If the soil is adequately drained, protected against flooding, and otherwise intensively managed, some specialty crops can be grown. In areas that are drained and cultivated, the soil is subject to soil blowing and subsidence. The number of frost-free days per growing season is less on this soil than on adjacent upland soils because of cold air drainage.

Because of the high water table, the low natural fertility, and the flooding, this soil is generally unsuited to growing many of the pasture grasses and legumes. Unless the soil is adequately drained, reed canarygrass is the only suitable species. Low strength restricts the use of machinery and limits grazing.

This soil is suited to trees used for wood products. The wetness and the high water table during the planting season limit reforestation to natural regeneration. Harvesting with heavy equipment is limited to periods when the ground is frozen. Clear-cut or area-selection harvest methods are needed to avoid serious windthrow of the remaining trees. Suitable herbicides or mechanical removal can control the brush competing with natural regeneration.

This soil is generally unsuited as a site for septic tank absorption fields and dwellings and small commercial buildings because of the high water table, the flooding, and the low strength. It lacks the strength needed to support vehicular traffic, but replacing the organic layer with suitable base material can overcome this limitation. Roads should be constructed so that they do not restrict the natural drainage; restricted drainage would increase the wetness and decrease the productivity of the soil as woodland.

Capability subclass IIIw, drained, and VIw, undrained; woodland suitability subclass 3w.

ChB—Chetek sandy loam, 2 to 6 percent slopes. This undulating, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsurface layer is dark brown sandy loam about 2 inches thick. The subsoil is about 13 inches thick. It is dark brown loam over dark brown loamy sand. The underlying material to a depth of about 60 inches is strong brown, yellowish brown, and light yellowish brown coarse sand and gravel. In places the surface layer is loam. In some areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few areas of the well drained Rosholt soils, a few areas of the somewhat poorly drained Poskin soils and the Cromwell Variant in shallow depressions and narrow drainageways, and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 6 percent and a few where they are less than 2 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the upper loamy material and rapid in the underlying material. Available water capacity is low. Runoff is slow in cultivated areas. Organic-matter content is moderately low, and tilth is good.

Most areas are farmed. Some remain wooded or are pastured. The potential is fair for cultivated crops, pasture, woodland, and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. It is droughty, however, and crop yields in most years are limited as a result of the low available water capacity. A proper crop rotation and minimum tillage help to control erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves seedling survival. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent, however, can pollute ground water because the underlying material is rapidly permeable. The soil is also suited as a site for buildings and for local roads and streets. In some areas it is an important local source of sand and gravel for construction and road building.

Capability subclass IIIe; woodland suitability subclass 3s.

ChC2—Chetek sandy loam, 6 to 12 percent slopes, eroded. This rolling, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 2 to 30 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam. The subsurface layer is dark brown sandy loam about 2 inches thick. The subsoil is about 13 inches thick. It is dark brown loam over dark brown loamy sand. The underlying material to a depth of about 60 inches is strong brown, yellowish brown, and light yellowish brown coarse sand and gravel. In places the surface layer is loam. In some areas the underlying material contains little or no gravel. In many places plowing has mixed all of the subsurface layer with the surface layer.

Included with this soil in mapping are a few areas of the well drained Rosholt soils, a few areas of the somewhat poorly drained Poskin soils and the Cromwell Variant in shallow depressions and narrow drainageways, and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 12 percent and a few where they are less than 6 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the upper loamy material and rapid in the underlying material. Available water capacity is low. Runoff is medium in cultivated areas. Organic-matter content is low. Erosion has lowered the organic-matter content and the fertility level, decreased the capacity of the soil to retain water, and resulted in poorer tilth in the surface layer.

Most areas are farmed. A few remain wooded or are pastured. The potential is fair for cultivated crops, pasture, woodland, and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. It is droughty, however, and crop yields in most years are limited as a result of the low available water capacity. If cultivated crops are grown, the hazard of further erosion is moderate. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. Minimum tillage, winter cover crops, and spring plowing help to reduce soil losses in row cropped areas. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility.

This soil is suited to growing many of the pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves seedling survival. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent, however, can pollute ground water because the underlying material is rapidly permeable. Because of the slope, land shaping is needed on some building sites. The less sloping included areas are better building sites.

Cutting and filling generally are needed on sites for local roads and streets because this soil is rolling. Stabilizing road cuts is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations. In some areas this soil is an important local source of sand and gravel for construction and road building.

Capability subclass IVe; woodland suitability subclass 3s.

ChD2—Chetek sandy loam, 12 to 20 percent slopes, eroded. This hilly, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 6 inches thick. The subsoil is about 10 inches thick. It is dark brown loam over dark brown loamy sand. The underlying material to a depth of about 60 inches is strong brown, yellowish brown, and light yellowish brown coarse sand and gravel. In places the surface layer is loam. In some areas the underlying material contains little or no gravel. In uneroded areas a subsurface layer of dark brown sandy loam about 3 inches thick underlies the surface layer.

Included with this soil in mapping are a few areas of the well drained Rosholt soils, a few areas of the somewhat poorly drained Poskin soils and the Cromwell Variant in shallow depressions and narrow drainageways, and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 20 percent and a few where they are less than 12 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the upper loamy material and rapid in the underlying material. Available water capacity is low. Runoff is rapid in cultivated areas. Organic-matter content is low. Erosion has lowered the organic-matter content and the fertility level, decreased the capacity of the soil to retain water, and resulted in poorer tilth in the surface layer.

Most areas are farmed. A few remain wooded or are pastured. The potential is fair for woodland and pasture and poor for cultivated crops and most engineering uses.

Because of droughtiness and a severe hazard of further erosion, this soil is generally not suited to row crops. It is suited, however, to grasses and legumes for forage, which can be grown without excessive erosion. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility.

The use of this soil as pasture is effective in controlling erosion. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Erosion can be controlled by planting trees on the contour and by carefully locating skid roads during harvest (fig. 8). Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is poorly suited to septic tank absorption fields because it is hilly. This limitation, however, can be overcome by land shaping or avoided by selecting a less steep included area. The effluent from these absorption fields can pollute ground water because the underlying material is rapidly permeable.

Because of the slope, land shaping is needed on most building sites and extensive cutting and filling is needed on most sites for local roads and streets. Stabilizing road cuts is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations. In some areas this soil is an important source of sand and gravel for construction and road building.

Capability subclass VIe; woodland suitability subclass 3s.

CmA—Comstock silt loam, 0 to 3 percent slopes. This nearly level and undulating, somewhat poorly drained soil is on broad glacial lake plains and terraces. It is subject to rare flooding. Individual areas are irregular in shape and generally are 10 to 30 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown and grayish brown, mottled silt loam about 7 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dominantly dark yellowish brown and yellowish brown, mottled silt loam about 23 inches thick. It has thin strata of fine and very fine sand in the lower part. The underlying material to a depth of about 60 inches is yellowish brown, stratified silt, silt loam, and very fine sand. In places the surface layer is loam or very fine sandy loam. In a few areas the subsoil is fine sandy loam or is redder.

Included with this soil in mapping are a few small areas of the well drained Campia and moderately well drained Crystal Lake soils on convex slopes and a few small areas of the poorly drained Barronett soils in shallow depressions and narrow drainageways. Also included are small areas where the slope is more than 3 percent. Included areas make up 2 to 15 percent of the unit.

Permeability is moderate, and available water capacity is very high. Organic-matter content is moderate, and tilth is good. This soil is saturated within 1 foot to 3 feet of the surface during wet periods. In some areas it receives runoff from adjacent slopes and is likely to be ponded for brief periods after heavy rains.

Most areas are farmed. A few remain wooded or are pastured. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches and, in some areas, diversions is needed for dependable crop production. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. Artificial drainage is needed if a taprooted plant, such as alfalfa, is grown. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because it has a seasonal high water table, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, improves these absorption fields. The soil lacks the strength needed to support dwellings and small commercial buildings, but strengthening or replacing the base material can overcome this limitation. Building sites should be artificially drained. Diversions are needed to protect some of these sites from ponding. Strengthening or replacing the base material and adding suitable subbase material help to prevent the damage to local roads and streets caused by low strength and frost action.

Capability subclass IIw; woodland suitability subclass 2o.

CpA—Comstock Variant loam, 0 to 3 percent slopes. This nearly level and undulating, somewhat poorly drained soil is on broad glacial lake plains and terraces. Individual areas are irregular in shape and generally are 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsurface layer is pale brown, mottled fine sandy loam about 3 inches thick. The next 4 inches is multicolored sandy loam and fine sandy loam. The subsoil is brown and yellowish brown, mottled silty clay about 20 inches thick. The underlying material to a depth of about 60 inches is light yellowish brown, mottled silty clay. In places the surface layer and subsurface layer are sandy loam or silt loam. In some areas the upper part of the subsoil is loam or sandy loam.

Included with this soil in mapping are a few small areas of the well drained and moderately well drained Campia Variant on convex slopes and small areas of Plover and Poskin soils, which are more rapidly permeable than the Comstock Variant. Also included are a few areas where the slope is more than 3 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is moderate. Organic-matter content also is moderate, and tilth is good. The shrink-swell potential is moderate in the subsoil and in the underlying material. This soil is saturated within 1 foot to 3 feet of the surface during wet periods.

Many areas are farmed, and many remain wooded or are pastured. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches or tile is needed for dependable crop production. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. It should be artificially drained if a taprooted crop, such as alfalfa, is grown. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because of the seasonal high table and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, improves these absorption fields. On sites for dwellings and small commercial buildings, suitable base material is needed to prevent the damage caused by low strength and shrinking and swelling. Building sites should be artificially drained. Strengthening or replacing the base material and providing suitable subbase material help to prevent the damage to local roads and streets caused by frost action.

Capability subclass IIw; woodland suitability subclass 2o.

CrA—Cromwell sandy loam, 0 to 2 percent slopes. This nearly level, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 30 acres in size.

Typically, the surface layer is black sandy loam about 1 inch thick. The subsurface layer is dark brown sandy loam about 2 inches thick. The subsoil is about 27 inches thick. It is dark brown sandy loam over dark brown cobbly loamy sand and sand. The underlying material to a depth of about 60 inches is brown and dark brown sand. In places the surface layer is loam or loamy sand. In some areas the upper part of the subsoil is loamy sand. In cultivated areas plowing has mixed the subsurface layer and part of the subsoil with the surface layer.

Included with this soil in mapping are a few areas of the well drained Rosholt soils, a few areas of the somewhat poorly drained Cromwell Variant in shallow depressions and narrow drainageways, and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few small areas where the slope is more than 2 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderate in the upper loamy material and rapid in the underlying material. Available water capacity is low. Runoff is very slow in cultivated areas. Organic-matter content is low.

Most areas are woodland. Some are farmed or pastured. The potential is fair for cultivated crops and pasture and good for woodland and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. It is droughty, however, and crop yields are limited in most years as a result of the low available water capacity. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves seedling survival during dry periods. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent, however, can pollute ground water because the underlying material is rapidly permeable. The soil is suited as a site for buildings and for local roads and streets.

Capability subclass IIIs; woodland suitability subclass 2d.

CrB—Cromwell sandy loam, 2 to 6 percent slopes. This undulating, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 30 acres in size.

Typically, the surface layer is black sandy loam about 1 inch thick. The subsurface layer is dark brown sandy loam about 2 inches thick. The subsoil is about 27 inches thick. It is dark brown sandy loam over dark brown cobbly loamy sand and sand. The underlying material to a depth of about 60 inches is brown and dark brown sand. In places the surface layer is loam or loamy sand. In some areas the upper part of the subsoil is loamy sand. In cultivated areas plowing has mixed the subsurface layer and part of the subsoil with the surface layer.

Included with this soil in mapping are a few areas of the well drained Rosholt soils, a few areas of the somewhat poorly drained Cromwell Variant in shallow depressions and narrow drainageways, and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 6 percent and a few where they are less than 2 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderate in the upper loamy material and rapid in the underlying material. Available water capacity is low. Runoff is slow in cultivated areas. Organic-matter content is low.

Most areas are woodland. Some are farmed or pastured. The potential is fair for cultivated crops and pasture and good for woodland and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. It is droughty, however, and crop yields are limited in most years as a result of the low available water capacity. A proper crop rotation or minimum tillage helps to control erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves seedling survival during dry periods. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent, however, can pollute ground water because the underlying material is rapidly permeable. The soil is suited as a site for buildings and for local roads and streets.

Capability subclass IIIe; woodland suitability subclass 2d.

CrC—Cromwell sandy loam, 6 to 12 percent slopes. This rolling, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 25 acres in size.

Typically, the surface layer is black sandy loam about 1 inch thick. The subsurface layer is dark brown sandy loam about 2 inches thick. The subsoil is about 25 inches thick. It is dark brown sandy loam over dark brown cobbly loamy sand and sand. The underlying material to a depth of about 60 inches is brown and dark brown sand. In places the surface layer is loamy sand. In some areas the upper part of the subsoil is loamy sand. In cultivated areas plowing has mixed the subsurface layer and part of the subsoil with the surface layer.

Included with this soil in mapping are a few areas of the well drained Rosholt soils, a few small areas of the somewhat poorly drained Cromwell Variant and Poskin soils in shallow depressions, a few areas of the excessively drained Emmert soils on small kames and eskers, and a few areas where, as a result of loamy or silty bands in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 12 percent and small areas where they are less than 6 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate in the upper loamy material and rapid in the underlying material. Available water capacity is low. Runoff is medium in cultivated areas. Organic-matter content is low.

Most areas are woodland. A few are farmed or pastured. The potential is fair for cultivated crops and pasture and good for woodland and most engineering uses.

This soil is poorly suited to growing corn and small grain but is suited to growing grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is moderate. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. Minimum tillage, winter cover crops, and spring plowing help to reduce soil loss in row cropped areas. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility. This soil is droughty, and crop yields are limited in most years as a result of the low available water capacity.

This soil is suited to growing many of the pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves seedling survival during dry periods. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent, however, can pollute ground water because the underlying material is rapidly permeable. Because of the slope, land shaping is needed on building sites and cutting and filling generally are needed on sites for local roads and streets. The less sloping included areas are better building sites. Stabilizing road cuts is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations. In some areas this soil is an important local source of sand for construction and road building.

Capability subclass IVe; woodland suitability subclass 2d.

CrD—Cromwell sandy loam, 12 to 25 percent slopes. This hilly and very hilly, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 25 acres in size.

Typically, the surface layer is black sandy loam about 1 inch thick. The subsurface layer is dark brown sandy loam about 2 inches thick. The subsoil is about 25 inches thick. It is dark brown sandy loam over dark brown cobbly loamy sand and sand. The underlying material to a depth of about 60 inches is brown and dark brown sand. In places the surface layer or the upper part of the subsoil is loamy sand.

Included with this soil in mapping are a few areas of the well drained Rosholt soils, a few small areas of the somewhat poorly drained Cromwell Variant and Poskin soils in shallow depressions, a few areas of the excessively drained Emmert soils on small kames and eskers, and a few areas where, as a result of loamy or silty bands in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 25 percent and small areas where they are less than 12 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate in the upper loamy material and rapid in the underlying material. Available water capacity is low. Organic-matter content also is low.

Most areas are woodland. A few are pastured. The potential is good for woodland, fair for pasture, and poor for cultivated crops and most engineering uses.

Because of droughtiness and a severe hazard of erosion, this soil is generally not suited to row crops. Grasses and legumes for forage, however, can be grown without excessive erosion.

This soil is suited to growing many of the pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Erosion can be controlled by planting trees on the contour and by carefully locating skid roads during harvest. Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

Because it is hilly and very hilly, this soil is poorly suited to septic tank absorption fields. This limitation, however, can be overcome by land shaping or avoided by selecting a less steep included area. The effluent from these absorption fields can pollute ground water because the underlying material is rapidly permeable.

Because of the slope, land shaping is needed on building sites and extensive cutting and filling generally is needed on sites for local roads and streets. The less steep included areas are better building sites. Stabilizing road cuts is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations. In some areas this soil is an important local source of sand for construction and road building.

Capability subclass VIe; woodland suitability subclass 2d.

CsA—Cromwell Variant sandy loam, 0 to 3 percent slopes. This nearly level and undulating, somewhat poorly drained soil is on outwash plains and stream terraces. Individual areas are irregularly shaped or long and narrow and generally are 3 to 15 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 7 inches thick. The subsoil is about 13 inches thick. It is dark brown, mottled sandy loam over reddish brown, mottled loamy sand. The underlying material to a depth of about 60 inches is strong brown and reddish brown coarse sand and gravel. In places the surface layer is loam or fine sandy loam. In some areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few small areas of the somewhat excessively drained Cromwell and well drained Rosholt soils on convex slopes and a few areas of the poorly drained and very poorly drained Warman Variant in depressions and narrow drainageways. Also included are a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the upper loamy material and rapid in the underlying material. Available water capacity is low. Organic-matter content also is low. Runoff is slow in cultivated areas. This soil is saturated within 1 foot to 3 feet of the surface during wet periods.

Many areas remain wooded. Some are farmed or pastured. The potential is fair for cultivated crops and pasture, good for woodland, and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches or open ditches is needed for dependable crop production. The soil is droughty, and in most years crop yields are limited as a result of the low available water capacity. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. It should be artificially drained if a taprooted plant, such as alfalfa, is grown. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves the survival rate during dry periods. Clear-cut or area-selection harvest methods reduce the danger of windthrow to the remaining trees. Suitable herbicides or mechanical removal controls competing vegetation, which can interfere with natural regeneration following harvest.

Because it has a seasonal high water table, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, improves these absorption fields. Building sites should be artificially drained. Providing suitable subbase material helps to prevent the damage to local roads and streets caused by frost action.

Capability subclass IIIw; woodland suitability subclass 2d.

CtA—Croswell loamy sand, 0 to 3 percent slopes. This nearly level and undulating, moderately well drained soil is on glacial outwash plains and stream terraces. Individual areas are irregular in shape and generally are 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsoil is brown, strong brown, yellowish red, and reddish yellow sand about 32 inches thick. It is mottled below a depth of about 21 inches. The underlying material to a depth of about 60 inches is yellowish brown sand. In places the surface layer is fine sand or loamy fine sand. In some areas the subsoil and underlying material are fine sand.

Included with this soil in mapping are a few areas of the somewhat excessively drained Menahga and Omega soils, a few areas of the somewhat poorly drained Lino soils and poorly drained and very poorly drained Newson soils in shallow depressions and narrow drainageways, and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few small areas where the slope is more than 3 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is rapid, and available water capacity is low. Runoff is very slow in cultivated areas. Organic-matter content is low. This soil is saturated within 2 or 3 feet of the surface during wet periods.

Many areas remain wooded or are pastured. Some are farmed. The potential is poor for cultivated crops and pasture, good for woodland, and fair or poor for most engineering uses.

Because it is droughty, this soil is poorly suited to growing corn and small grain and to grasses and legumes for forage. In most years crop yields are limited as a result of the low available water capacity. Some areas have potential as irrigated cropland. Winter cover crops, crop residue management, and field windbreaks help to prevent excessive soil blowing. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing only certain pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazed pastures are subject to soil blowing. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal controls competing vegetation, which can interfere with natural regeneration following harvest.

Because it has a seasonal high water table, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material improves these absorption fields. Building sites should be artificially drained, especially if dwellings with basements are constructed.

Capability subclass IVs; woodland suitability subclass 2s.

CuA—Crystal Lake silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on broad glacial lake plains. Individual areas are irregular in shape and generally are 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is light brownish gray silt loam about 4 inches thick. The next 8 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark yellowish brown, mottled silt loam about 12 inches thick. It has thin strata of very fine sandy loam in the lower part. The underlying material to a depth of about 60 inches is yellowish brown, mottled silt loam that has thin strata of very fine sand. In places the surface layer is loam or very fine sandy loam. In a few areas the subsoil is fine sandy loam or is redder.

Included with this soil in mapping are a few small areas of the well drained Campia soils on small convex slopes and a few areas of the somewhat poorly drained Comstock soils in shallow depressions. Also included are small areas where the slope is more than 2 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderate, and available water capacity is very high. Organic-matter content is moderate, and tilth is good. This soil is saturated within 2 1/2 to 3 1/2 feet of the surface during wet periods.

Most areas are farmed. Only a few areas are pasture or woodland. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

Although little of the acreage is woodland, this soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because it has a seasonal high water table, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material improves these absorption fields. The soil lacks the strength needed to support vehicular traffic and dwellings and small commercial buildings, but strengthening or replacing the base material can overcome this limitation. Artificial drainage is needed on sites for dwellings with basements. Providing suitable subbase material helps to prevent the road damage caused by frost action.

Capability class I; woodland suitability subclass 2o.

CuB—Crystal Lake silt loam, 2 to 6 percent slopes. This undulating, moderately well drained soil is on broad glacial lake plains and terraces. Individual areas are irregular in shape and generally are 5 to 12 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is light brownish gray silt loam about 4 inches thick. The next 8 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark yellowish brown, mottled silt loam about 12 inches thick. It has thin strata of very fine sandy loam in the lower part. The underlying material to a depth of about 60 inches is yellowish brown, mottled silt loam that has thin strata of very fine sand. In places the surface layer is loam or very fine sandy loam or is redder.

Included with this soil in mapping are a few small areas of the well drained Campia soils on convex slopes and a few areas of the somewhat poorly drained Comstock soils in shallow depressions. Also included are a few areas where slopes are short and more than 6 percent and a few areas where they are less than 2 percent. Included areas make up 2 to 15 percent of the unit.

Permeability is moderate, and available water capacity is very high. Organic-matter content is moderate, and tilth is good. This soil is saturated within 2 1/2 to 3 1/2 feet of the surface during wet periods.

Most areas are farmed. Only a few areas are pasture or woodland. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. In most areas row crops can be grown year after year without excessive soil loss if tillage is kept to a minimum. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

Although little of the acreage is woodland, this soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is poorly suited to septic tank absorption fields because it has a seasonal high water table. A filtering mound of suitable material, however, improves these absorption fields. The soil lacks the strength needed to support vehicular traffic and dwellings and small commercial buildings, but strengthening or replacing the base material can overcome this limitation. Artificial drainage is needed on sites for dwellings with basements. Providing suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IIe; woodland suitability subclass 2o.

CvB—Cushing loam, 2 to 6 percent slopes. This undulating, well drained and moderately well drained soil is on plane or convex ridgetops on glacial moraines. Individual areas are irregular in shape and generally are 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer is brown loam about 7 inches thick. The next 4 inches is a mixture of brown and dark brown loam. The subsoil is dark brown sandy clay loam about 22 inches thick. It is mottled in the lower part. The underlying material to a depth of about 60 inches is dark brown loam. In places the surface layer is sandy loam, loamy sand, or silt loam. In a few areas the underlying material has bands of sand or gravelly sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Alstad soils on concave slopes or in shallow depressions. Also included are a few areas where slopes are short and more than 6 percent and a few where they are less than 2 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderately slow, and available water capacity is high. Runoff is slow in cultivated areas. Organic-matter content is moderate, and tilth is good. In undrained areas this soil is saturated within 3 to 6 feet of the surface during wet periods.

Most areas are farmed. A few remain wooded or are pastured. The potential is good for cultivated crops, pasture, and woodland and fair or poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is slight. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations, minimum tillage, and spring plowing help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because it is too slowly permeable and in some areas has a water table too near the surface, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, improves these absorption fields. The soil lacks the strength needed to support dwellings and small buildings and vehicular traffic, but providing suitable base material can overcome this limitation.

Capability subclass IIe; woodland suitability subclass 2o.

CvC2—Cushing loam, 6 to 12 percent slopes, eroded. This rolling, well drained soil is on the sides and convex tops of ridges on glacial moraines. Individual areas are irregular in shape and generally are 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The next 4 inches is a mixture of brown and dark brown loam. The subsoil is dark brown sandy clay loam about 22 inches thick. The underlying material to a depth of about 60 inches is dark brown loam. In uncultivated areas the surface layer is very dark grayish brown loam about 3 inches thick. In places it is sandy loam, loamy sand, or silt loam. In a few areas the underlying material has bands of sand or gravelly sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Alstad soils on concave slopes and the poorly drained and very poorly drained Bluffton soils in shallow depressions. Also included are a few areas where slopes are short and more than 12 percent and small areas where they are less than 6 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is moderately slow, and available water capacity is high. Runoff is medium in cultivated areas. Organic-matter content is low. Erosion has lowered the organic-matter content and the fertility level, decreased the capacity of the soil to retain water, and resulted in poorer tilth in the surface layer.

Most areas are farmed. A few remain wooded or are pastured. The potential is good for cultivated crops, pasture, and woodland and fair or poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of further erosion is moderate. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation can prevent excessive soil loss. Minimum tillage, winter cover crops, and spring plowing help to reduce soil loss in row cropped areas. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because it is too slowly permeable, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material improves these absorption fields. The soil lacks the strength needed to support dwellings and small commercial buildings and vehicular traffic, but providing suitable base material can overcome this limitation. Because of the slope, land shaping is needed on building sites. The less sloping included areas are better building sites.

Capability subclass IIIe; woodland suitability subclass 2o.

CvD—Cushing loam, 12 to 20 percent slopes. This hilly, well drained soil is on the sides and convex tops of ridges on glacial moraines. Individual areas are irregular in shape and generally are 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is brown loam about 12 inches thick. The next 4 inches is a mixture of brown and dark brown loam. The subsoil is dark brown sandy clay loam about 20 inches thick. The underlying material to a depth of about 60 inches is dark brown loam. In places the surface layer is sandy loam, loamy sand, or silt loam. In a few areas the underlying material has bands of sand or gravelly sand. In cultivated areas, which commonly are eroded, plowing has mixed most or all of the subsurface layer with the surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Alstad soils on concave slopes and the poorly drained and very poorly drained Bluffton and Cathro soils in shallow depressions. Also included are a few areas where slopes are short and more than 20 percent and a few where they are less than 12 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is high. Organic-matter content is moderate, and tilth is good.

Most areas are woodland. The potential is good for woodland, fair for pasture, and poor for cultivated crops and most engineering uses.

This soil is poorly suited to growing corn and small grain but is suited to growing grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is severe. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Proper crop rotations, minimum tillage, and spring plowing help to prevent excessive soil loss.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing, however, results in surface compaction, poor tilth, and excessive erosion. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The soil related problems of forest management are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Care in planting and selection of vigorous planting stock improve the survival rate on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because it is too slowly permeable and too steep, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material helps to overcome the moderately slow permeability. The less steep included areas are better sites for these absorption fields.

The slope limits this soil as a site for dwellings, but this limitation can be overcome by land shaping or avoided by selecting a less steep included area. On sites for local roads and streets, extensive cutting and filling generally is needed because slopes are hilly and irregular. The soil lacks the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation.

Capability subclass IVe; woodland suitability subclass 2r.

CvE—Cushing loam, 20 to 30 percent slopes. This very hilly, well drained soil is on the sides and convex tops of ridges on glacial moraines. Individual areas are irregular in shape and generally are 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is brown loam about 9 inches thick. The next 4 inches is a mixture of brown and dark brown loam. The subsoil is dark brown sandy clay loam about 15 inches thick. The underlying material to a depth of about 60 inches is dark brown loam. In places the surface layer is sandy loam, loamy sand, or silt loam. In a few areas the underlying material has bands of sand or gravelly sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Alstad soils on concave slopes and the poorly drained and very poorly drained Bluffton and Cathro soils in shallow depressions. Also included are a few areas where slopes are short and more than 30 percent and a few where they are less than 20 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is high. Organic-matter content is moderate, and tilth is good.

Most areas are woodland. The potential is good for woodland, fair for pasture, and poor for cultivated crops and most engineering uses.

Because it is very hilly, this soil is generally unsuited to cultivated crops. It is suited, however, to growing many of the pasture grasses and legumes. Overgrazing results in surface compaction, poor tilth, and excessive erosion. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The soil related problems of forest management are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Care in planting and selection of vigorous planting stock improve the survival rate on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because it is too slowly permeable and too steep, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material helps to overcome the moderately slow permeability. The less steep included areas are better sites for these absorption fields.

The slope limits this soil as a site for dwellings, but this limitation can be overcome by land shaping or avoided by selecting a less steep included area. On sites for local roads and streets, extensive cutting and filling is needed. The soil lacks the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation.

Capability subclass VIe; woodland suitability subclass 2r.

CwD3—Cushing soils, 12 to 25 percent slopes, severely eroded. These hilly and very hilly, well drained soils are on the sides and convex tops of ridges on glacial moraines. Individual areas are irregular in shape and generally are 5 to 15 acres in size.

Typically, the surface layer is dark brown sandy clay loam or clay loam about 6 inches thick. The subsoil is dark brown sandy clay loam about 19 inches thick. The underlying material to a depth of about 60 inches is dark brown loam. The texture of the surface layer varies widely. It can be fine sandy loam and loam in the less eroded areas. In a few places the surface layer overlies a brown loam subsurface layer about 4 inches thick. In a few areas the underlying material has bands of sand or gravelly sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Alstad soils on concave slopes and the poorly drained and very poorly drained Bluffton and Cathro soils in shallow depressions. In some of these depressions several feet of colluvium washed in from the adjacent soils. Also included are a few areas where slopes are short and more than 25 percent and a few small areas where they are less than 12 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is high. Organic-matter content is low. Erosion has lowered the organic-matter content and the fertility level, decreased the infiltration rate and the capacity of the soil to retain water, and resulted in poorer tilth in the surface layer.

Many areas formerly were cultivated but are now pasture or are idle land. Some areas are farmed. The potential is fair for pasture and woodland and poor for cultivated crops and most engineering uses.

These soils are generally unsuited to cultivated crops because of the erosion damage already evident and the severe hazard of further erosion. They are suited, however, to growing many of the pasture grasses and legumes. Overgrazing results in surface compaction and excessive erosion. Proper stocking rates and pasture rotations keep the pasture in good condition and help to control erosion.

These soils are suited to trees used for wood products. The soil related problems of forest management are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Care in planting and selection of vigorous planting stock improve the survival rate on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because they are too slowly permeable and too steep, these soils are poorly suited to septic tank absorption fields. A filtering mound of suitable material helps to overcome the moderately slow permeability. The less steep included areas are better sites for these absorption fields.

The slope limits these soils as sites for dwellings, but this limitation can be overcome by land shaping or avoided by selecting a less steep included area. On sites for local roads and streets, extensive cutting and filling generally is needed. The soils lack the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation.

Capability subclass VIe; woodland suitability subclass 2r.

CxB—Cushing complex, 2 to 6 percent slopes. This map unit consists of undulating, somewhat excessively drained, well drained, and moderately well drained soils formed in mixed glacial drift on pitted glacial moraines. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 5 to 25 acres in size. They are 55 to 65 percent Cushing soils and 15 to 25 percent Alban, Brill, Campia, Cromwell, Menahga, and Rosholt soils. These soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Cushing soil has a surface layer of very dark grayish brown loam about 9 inches thick. The subsurface layer is brown loam about 7 inches thick. The next 4 inches is a mixture of brown and dark brown loam. The subsoil is dark brown sandy clay loam about 22 inches thick. It is mottled in the lower part. The underlying material to a depth of about 60 inches is dark brown loam. In places the surface layer is sandy loam, loamy sand, or silt loam.

The Alban, Campia, and Rosholt soils are well drained, the Cromwell and Menahga soils somewhat excessively drained, and the Brill soils moderately well drained. The Alban soils formed in loamy material over glacial lacustrine sediments, the Brill soils in silty material over glacial outwash sediments, the Campia soils in silty material over glacial lacustrine sediments, the Cromwell and Rosholt soils in loamy material over glacial outwash sediments, and the Menahga soils in sandy glacial outwash.

Included with these soils in mapping are small areas of the somewhat poorly drained Alstad and Poskin soils on concave slopes and in shallow depressions. Also included are small areas of the poorly drained or very poorly drained Bluffton, Rifle, and Seelyeville soils in deep depressions and a few areas where the slope is more than 6 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately slow and available water capacity high in the Cushing soil. In the Alban, Brill, Campia, Cromwell, Menahga, and Rosholt soils, permeability is moderate to very rapid and available water capacity is very high to low. Runoff is slow in cultivated areas. The Cromwell and Menahga soils are droughty.

Most areas are farmed or pastured. Many remain woodland. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

These soils are suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is slight or moderate. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive erosion. Minimum tillage and winter cover crops in combination with spring plowing help to reduce soil losses in row cropped areas. Because the soils are droughty in some areas, some crops mature unevenly. Wet depressions interfere with cultivation. Draining these depressions generally is difficult. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility and increases the rate of water infiltration.

These soils are suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because this map unit is complex, onsite investigation is needed to select suitable areas large enough for septic tank absorption fields or for building site development. In most areas permeability is too slow for septic tank absorption fields, but a filtering mound of suitable material helps to overcome this limitation.

In most areas these soils lack the strength needed to support vehicular traffic and dwellings and small commercial buildings, but providing suitable base material can overcome this limitation. Adding suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IIe; woodland suitability subclass 2o.

CxC2—Cushing complex, 6 to 12 percent slopes, eroded. This map unit consists of rolling, somewhat excessively drained and well drained soils formed in mixed glacial drift on pitted glacial moraines. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 10 to 40 acres in size. They are 50 to 60 percent Cushing soils and 20 to 30 percent Alban, Antigo, Campia, Cromwell, Menahga, and Rosholt soils. These soils are so intricately mixed or are such small areas that mapping them separately is not practical.

Typically, the Cushing soil has a surface layer of dark grayish brown loam about 7 inches thick. The next 4 inches is a mixture of brown and dark brown loam. The subsoil is dark brown sandy clay loam about 22 inches thick. The underlying material to a depth of about 60 inches is dark brown loam. In uncultivated areas a very dark grayish brown surface layer about 3 inches thick overlies a brown loam subsurface layer about 9 inches thick. In places the surface layer is sandy loam, loamy sand, or silt loam.

The Alban, Antigo, Campia, and Rosholt soils are well drained and the Cromwell and Menahga soils somewhat excessively drained. The Alban soils formed in loamy material over glacial lacustrine sediments, the Antigo soils in silty material over glacial outwash sediments, the Campia soils in silty material over glacial lacustrine sediments, the Cromwell and Rosholt soils in loamy material over glacial outwash sediments, and the Menahga soils in sandy glacial outwash.

Included with these soils in mapping are small areas of the somewhat poorly drained Alstad and Poskin soils on concave slopes and in shallow depressions. Also included are small areas of the poorly drained or very poorly drained Bluffton, Rifle, and Seelyeville soils in deep depressions; a few areas where the slope is more than 12 percent; and small areas where it is less than 6 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately slow and available water capacity high in the Cushing soil. In the Alban, Antigo, Campia, Cromwell, Menahga, and Rosholt soils, permeability is moderate to very rapid and available water capacity very high to low. Runoff is medium in cultivated areas. Erosion has lowered the organic-matter content and the fertility level, decreased the capacity of the soil to retain water, and resulted in poorer tilth in the surface layer. The Cromwell and Menahga soils are droughty.

Most areas are farmed or pastured. Many remain woodland. The potential is fair for cultivated crops, good for pasture and woodland, and poor for most engineering uses.

These soils are suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of further erosion is moderate. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive erosion. Minimum tillage and winter cover crops in combination with spring plowing help to reduce soil losses in row cropped areas. Because these soils are droughty in some areas, some crops mature unevenly. Wet depressions interfere with cultivation. Draining these depressions generally is difficult. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility and increases the rate of water infiltration.

These soils are suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because this map unit is complex, careful onsite investigation is needed to select suitable areas large enough for septic tank absorption fields or for building site development. In most areas permeability is too slow for septic tank absorption fields, but a filtering mound of suitable material helps to overcome this limitation.

In most areas these soils lack the strength needed to support vehicular traffic and dwellings and small commercial buildings. Providing suitable base material, however, can overcome this limitation. Adding suitable subbase material helps to prevent the road damage caused by frost action. On sites for local roads or streets, extensive cutting and filling generally is needed because slopes are rolling and irregular.

Capability subclass IIIe; woodland suitability subclass 2o.

CxD2—Cushing complex, 12 to 20 percent slopes, eroded. This map unit consists of hilly, somewhat excessively drained and well drained soils formed in mixed glacial drift on pitted glacial moraines. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 5 to 40 acres in size. They are 45 to 55 percent Cushing soils and 25 to 35 percent Alban, Antigo, Campia, Cromwell, Menahga, and Rosholt soils. These soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Cushing soil has a surface layer of dark grayish brown loam about 7 inches thick. The next 4 inches is a mixture of brown and dark brown loam. The subsoil is dark brown sandy clay loam about 20 inches thick. The underlying material to a depth of about 60 inches is dark brown loam. In uncultivated areas a very dark grayish brown surface layer about 3 inches thick overlies a brown loam subsurface layer about 9 inches thick. In places the surface layer is sandy loam, loamy sand, or silt loam.

The Alban, Antigo, Campia, and Rosholt soils are well drained and the Cromwell and Menahga soils somewhat excessively drained. The Alban soils formed in loamy material over glacial lacustrine sediments, the Antigo soils in silty material over glacial outwash sediments, the Campia soils in silty material over glacial lacustrine sediments, the Cromwell and Rosholt soils in loamy material over glacial outwash sediments, and the Menahga soils in sandy glacial outwash.

Included with these soils in mapping are small areas of the somewhat poorly drained Alstad and Poskin soils on concave slopes and in shallow depressions. Also included are small areas of the poorly drained or very poorly drained Bluffton, Rifle, and Seelyeville soils in deep depressions; a few areas where the slope is more than 20 percent; and small areas where it is less than 12 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately slow and available water capacity high in the Cushing soil. In the Alban, Antigo, Campia, Cromwell, Menahga, and Rosholt soils, permeability is moderate to very rapid and available water capacity very high to low. Runoff is rapid in cultivated areas. Erosion has lowered the organic-matter content and the fertility level, decreased the capacity of the soil to retain water, and resulted in poorer tilth in the surface layer. The Cromwell and Menahga soils are droughty.

Most areas are farmed or pastured. Many remain woodland. The potential is poor for cultivated crops, good for pasture and woodland, and poor for most engineering uses.

These soils are poorly suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of further erosion is severe. Slopes are too short and irregular for strip-cropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive erosion. Minimum tillage and winter cover crops in combination with spring plowing reduce soil losses in row cropped areas. Because the soils are droughty in some areas, some crops mature unevenly. Wet depressions interfere with cultivation. Draining these depressions generally is difficult. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility and increases the rate of water infiltration.

These soils are suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The soil related problems of forest management are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Care in planting and selection of vigorous planting stock improve the survival rate on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because this map unit is complex, onsite investigation is needed to select suitable areas large enough for septic tank absorption fields or for building site development. In most areas the soils are too slowly permeable and too steep for septic tank absorption fields. A filtering mound of suitable material is beneficial.

Because of the slope, land shaping generally is needed on building sites. The less steep included areas can be used as building sites. In most areas these soils lack the strength needed to support vehicular traffic and dwellings and small commercial buildings. Providing suitable base material, however, can overcome this limitation. Adding suitable subbase material helps to prevent the road damage caused by frost action. On sites for local roads or streets, extensive cutting and filling generally is needed because slopes are hilly and irregular.

Capability subclass IVe; woodland suitability subclass 2r.

DaA—Dakota loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad glacial outwash plains and stream terraces. Individual areas are irregular in shape and generally are 10 to 100 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown loam about 16 inches thick. The subsoil is about 22 inches thick. It is dark brown and dark yellowish brown loam over dark brown and strong brown loamy sand and sand. The underlying material to a depth of about 60 inches is light yellowish brown, stratified sand, coarse sand, and gravel. In places the surface layer is silt loam or fine sandy loam. In some areas the upper part of the subsoil is silt loam.

Included with this soil in mapping are small areas of the somewhat excessively drained Burkhardt and Hubbard soils and small areas of the Dakota Variant in shallow depressions and narrow drainageways. Also included are small areas where the slope is more than 2 percent and a few areas where limestone bedrock is within 60 inches of the surface. Included areas make up 2 to 10 percent of the unit.

Permeability is moderate in the upper loamy material and very rapid in the underlying material. Available water capacity is moderate. Organic-matter content is high, and tilth is good.

Most areas are farmed. A few are pastured. This soil is not naturally forested and generally is not managed as woodland. It has good potential for cultivated crops, pasture, and most engineering uses.

This soil is suited to growing corn, soybeans, and small grain and to grasses and legumes for forage. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. Crop yields are limited during dry periods as a result of the moderate available water capacity.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because the underlying material is very rapidly permeable. The soil lacks the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation.

Capability subclass IIs; not assigned to a woodland suitability subclass.

DaB—Dakota loam, 2 to 6 percent slopes. This undulating, well drained soil is on broad glacial outwash plains and stream terrraces. Individual areas are irregular in shape and generally are 5 to 20 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown loam about 16 inches thick. The subsoil is about 22 inches thick. It is dark brown and dark yellowish brown loam over dark brown and strong brown loamy sand and sand. The underlying material to a depth of about 60 inches is light yellowish brown, stratified sand, coarse sand, and gravel. In places the surface layer is silt loam or fine sandy loam. In some areas the upper part of the subsoil is silt loam.

Included with this soil in mapping are small areas of the somewhat excessively drained Burkhardt and Hubbard soils. Also included are small areas of the Dakota Variant in shallow depressions and narrow drainageways, areas where slopes are short and more than 6 percent, small areas where they are less than 2 percent, and a few areas where limestone bedrock is within 60 inches of the surface. Included areas make up 2 to 15 percent of the unit.

Permeability is moderate in the upper loamy material and very rapid in the underlying material. Available water capacity is moderate. Organic-matter content is high, and tilth is good.

Most areas are farmed. A few are pastured. This soil is not naturally forested and generally is not managed as woodland. It has good potential for cultivated crops, pasture, and most engineering uses.

This soil is suited to growing corn, soybeans, and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. In most areas row crops can be grown year after year without excessive soil loss if tillage is kept to a minimum. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. Crop yields are limited during dry periods as a result of the moderate available water capacity.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because the underlying material is very rapidly permeable. The soil lacks the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation.

Capability subclass IIe; not assigned to a woodland suitability subclass.

DlA—Dakota loam, limestone substratum, 0 to 3 percent slopes. This nearly level and gently sloping, well drained soil is on broad glacial outwash plains and stream terraces. It is underlain by dolomitic limestone bedrock. Individual areas are irregular in shape and generally are 5 to 25 acres in size.

Typically, the surface layer is black and very dark brown loam about 15 inches thick. The subsoil is about 17 inches thick. It is dark brown and dark yellowish brown loam over dark yellowish brown loamy sand. The underlying material, to a depth of about 44 inches, is dark brown gravelly sand. Dolomitic limestone bedrock is at a depth of about 44 inches. In places the surface layer and subsoil are silt loam or fine sandy loam.

Included with this soil in mapping are small areas of the somewhat excessively drained Burkhardt soils and a few areas of the somewhat poorly drained Dakota Variant in shallow depressions and narrow drainageways. Also included are a few areas where bedrock either crops out or is at a depth of more than 60 inches and a few areas where the slope is more than 3 percent. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper loamy material and very rapid in the underlying material. Available water capacity is moderate. Organic-matter content is high, and tilth is good. Fractured dolomitic limestone bedrock is at a depth of 40 to 60 inches.

Most areas are farmed. A few are pastured. This soil is not naturally forested and generally is not managed as woodland. It has good potential for cultivated crops and pasture and fair to poor potential for most engineering uses.

This soil is suited to growing corn, soybeans, and small grain and to grasses and legumes for forage. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. Crop yields are limited during dry periods as a result of the moderate available water capacity.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

Because of the depth to bedrock, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material helps to overcome this limitation. Excavating for basements is difficult because of the bedrock. The soil lacks the strength needed to support vehicular traffic, but strengthening or replacing the base material can overcome this limitation.

Capability subclass IIs; not assigned to woodland suitability subclass.

DvA—Dakota Variant silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in concave areas and drainageways on broad glacial outwash plains. It is subject to rare flooding. Individual areas are oval or long and narrow and generally are 5 to 25 acres in size.

Typically, the surface layer is black and very dark grayish brown silt loam about 13 inches thick. The subsoil is about 21 inches thick. It is dark brown and dark yellowish brown, mottled loam over brown, mottled gravelly loamy coarse sand. The underlying material to a depth of about 60 inches is light yellowish brown, stratified sand and gravel. In places the surface layer is loam or fine sandy loam. In some areas the upper part of the subsoil is silt loam. In a few areas the underlying material contains little or no gravel.

Included with this soil in mapping are small areas of the somewhat excessively drained Burkhardt and Hubbard soils and well drained Dakota soils on convex slopes and a few areas where, as a result of loamy or silty lenses in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 3 percent and a few where limestone bedrock is within 60 inches of the surface. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate in the upper silty and loamy material and very rapid in the underlying material. Available water capacity is moderate. Organic-matter content is high, and tilth is good. This soil is saturated within 1 foot to 3 feet of the surface during wet periods. Some areas receive runoff from adjacent slopes and are likely to be ponded for brief periods after heavy rains.

Most areas are farmed. A few are pastured. This soil is not naturally forested and generally is not managed as woodland. It has good potential for cultivated crops and pasture and poor potential for most engineering uses.

This soil is suited to growing corn, soybeans, and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches and, in some areas, diversions is needed for dependable crop production. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. It should be artificially drained if a taprooted plant, such as alfalfa, is grown. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

Because it has a seasonal high water table, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, helps to overcome this limitation. On building sites artificial drainage is needed. In some areas diversions are needed to protect the site from ponding. Providing suitable subbase material helps to prevent the damage to local roads and streets caused by frost action.

Capability subclass IIw; not assigned to a woodland suitability subclass.

EmD—Emmert gravelly sandy loam, 12 to 35 percent slopes. This hilly and steep and very steep, excessively drained soil is on kames and eskers on pitted outwash plains. Individual areas are round or long and narrow and generally are 2 to 10 acres in size.

Typically, the surface layer is very dark grayish brown gravelly sandy loam about 3 inches thick. The underlying material to a depth of about 60 inches is reddish brown and strong brown gravelly coarse sand and stratified sand and gravel. In places the surface layer is loamy sand or sandy loam.

Included with this soil in mapping are small areas of the somewhat excessively drained Cromwell and Chetek soils and well drained Rosholt soils on concave slopes. Also included are a few areas where the underlying material is sand or coarse sand and small areas where the slope is less than 12 percent. Included areas make up 5 to 10 percent of the unit.

Permeability is very rapid, and available water capacity is very low. This soil is very droughty. Organic-matter content and natural fertility are low.

Most areas are wooded. Some are pastured. Gravel pits are in many areas. The potential is poor for cultivated crops, pasture, woodland, and most engineering uses.

Because it is too droughty and too steep, this soil is generally unsuited to cultivated crops and to many of the pasture grasses and legumes. Bluegrass should be favored in areas where pasture renovation is not feasible but where lime and fertilizer can be applied, brush removed, and grazing controlled.

This soil is poorly suited to woodland. Trees grow slowly and tend to have poor form. Planting trees on the contour and carefully locating skid roads help to control erosion. Carefully planting vigorous nursery stock can overcome the poor survival rate during dry periods.

Because of the slope, this soil is poorly suited to septic tank absorption fields. Also, the effluent can pollute ground water because permeability is very rapid.

The slope limits this soil as a site for dwellings and small commercial buildings, but this limitation can be overcome by extensive land shaping or avoided by selecting the less steep included areas. On sites for local roads and streets, extensive cutting and filling generally is needed because of the slope. Stabilizing road cuts is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations. This soil is an important source of sand and gravel for construction and road building.

Capability subclass VIIs; woodland suitability subclass 4f.

Fa—Fluvaquents. These nearly level, moderately well drained and somewhat poorly drained soils are on flood plains dissected by streams. They are subject to frequent flooding. Individual areas are long and narrow and generally are 5 to 25 acres in size. The microrelief is one of low, flattopped ridges and small valleys formed through erosion and through deposition by floodwater.

The color, texture, and thickness of individual layers vary widely. As a result, these soils cannot be classified at the series level. They typically consist of alternating layers of sand, loamy sand, and sandy loam but have a few strata of loam, silt loam, or silt in many areas.

Included with these soils in mapping are a few areas of the poorly drained and very poorly drained, wet Fluvaquents in slightly lower positions and in old stream channels. Also included are a few areas of the moderately well drained Croswell and somewhat poorly drained Lino soils, which are sandy throughout. Included areas make up 2 to 15 percent of the unit.

These Fluvaquents are saturated within 1 foot to 3 1/2 feet of the surface during wet periods.

Most areas are woodland. Many wooded areas are managed as wildlife habitat. The potential is poor for cultivated crops and most engineering uses and fair for pasture and woodland.

These soils are generally not used for cultivated crops because of the frequent flooding. Providing protection against flooding is difficult. Some areas are pastured. Because the soils are wet and subject to frequent flooding, bluegrass is commonly grown. Restricting grazing to dry periods helps to prevent surface compaction and poor tilth.

These soils are suited to trees used for wood products. Competition from brush can interfere with natural regeneration following harvest. It can be reduced by suitable herbicides or by mechanical removal of the brush. Flooding restricts the use of equipment during part of the year.

These soils are generally unsuitable as sites for septic tank absorption fields, dwellings and small commercial buildings, and local roads and streets because of the seasonal high water table and the frequent flooding. Roads, buildings, and other structures that restrict the flow of floodwater can cause more serious flooding problems on other parts of the flood plain.

Capability subclass IIIw; woodland suitability subclass 3o.

Fe—Fluvaquents, wet. These nearly level, poorly drained and very poorly drained soils are on flood plains dissected by streams. They are subject to frequent flooding. Individual areas are long and narrow and generally are 5 to 100 acres in size. The microrelief commonly is one of low, flattopped ridges and small valleys formed through erosion and through deposition by floodwater.

The color, texture, and thickness of individual layers vary widely. As a result, these soils cannot be classified at the series level. They typically consist of alternating layers of loam, silt loam, silt, sandy loam, loamy sand, sand, gravelly coarse sand, muck, and mucky peat. In places they are sandy throughout.

Included with these soils in mapping are small areas of the moderately well drained and somewhat poorly drained Fluvaquents in slightly higher positions and small areas of the very poorly drained Cathro, Markey, and Seelyeville soils. Also included are a few small areas of colluvial soils in upland depressions. Included areas make up 5 to 15 percent of the unit.

These Fluvaquents are saturated within a foot of the surface during most of the year.

Most areas are woodland. Many wooded areas are managed as wildlife habitat. The potential is poor for cultivated crops, pasture, woodland, and most engineering uses.

These soils are generally unsuited to cultivated crops and pasture because of the high water table and the flood hazard. Providing adequate drainage and protection against flooding is difficult.

These soils are poorly suited to woodland. Trees grow slowly and tend to have poor form. Because the soils are wet, the trees generally should be planted on prepared ridges if natural regeneration is unreliable. Selection of large, vigorous nursery stock helps to prevent a high mortality rate. Harvest is frequently limited to periods when the ground is frozen. Clear-cut or group-selection harvest methods reduce the danger of windthrow to the remaining trees. Suitable herbicides or mechanical removal can control competing vegetation, which interferes with natural regeneration.

These soils are generally unsuitable as sites for septic tank absorption fields, dwellings and small commercial buildings, and local roads and streets because of the high water table and the frequent flooding. Roads, buildings, and other structures that restrict the flow of floodwater can cause more serious flooding problems on other parts of the flood plain.

Capability subclass Vw; woodland suitability subclass 4w.

FnB—Freeon silt loam, 2 to 6 percent slopes. This undulating or gently sloping, moderately well drained soil is on the sides and convex tops of ridges on glacial moraines. Individual areas are irregular in shape and generally are 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The next 10 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 12 inches thick. It is brown, mottled silt loam over reddish brown, mottled sandy loam. The underlying material to a depth of about 60 inches is reddish brown sandy loam. In places the subsoil is silt loam. In a few areas the underlying material has strata of loamy sand or sand.

Included with this soil in mapping are a few areas of the well drained Santiago and Amery soils on convex slopes and a few small areas of the somewhat poorly drained Magnor soils in shallow depressions and narrow drainageways. Also included are a few areas where slopes are short and more than 6 percent and a few where they are less than 2 percent. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is moderate. Runoff is slow in cultivated areas. Organic-matter content is moderate, and tilth is good. This soil is saturated within 2 or 3 feet of the surface during wet periods. Root penetration is somewhat restricted by compact glacial till below a depth of about 32 inches.

Many areas are farmed or pastured, and many remain wooded. The potential is good for cultivated crops, pasture, and woodland and fair or poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is slight. On long and uniform slopes, stripcropping, terracing, and farming on the contour help to control erosion. In areas where slopes are short and irregular, a proper crop rotation and minimum tillage are the best methods of controlling erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because of the seasonally perched water table and the moderate or moderately slow permeability, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, improves these absorption fields.

This soil lacks the strength needed to support the dwellings and small commercial buildings, but replacing the base material can overcome this limitation and the risk of damage caused by shrinking and swelling. Artificial drainage is needed on sites for dwellings with basements. Providing suitable base and subbase material helps to prevent the damage to local roads and streets resulting from low strength and frost action.

Capability subclass IIe; woodland suitability subclass 2o.

HrB—Hubbard loamy sand, 0 to 6 percent slopes. This nearly level and undulating, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 20 acres in size.

Typically, the surface layer is very dark brown loamy sand about 18 inches thick. The next 6 inches is dark brown sand. The underlying material to a depth of about 60 inches is dark brown and dark yellowish brown sand. In places the surface layer is sandy loam or loamy fine sand or is thinner or lighter colored.

Included with this soil in mapping are a few areas of the well drained Dakota soils and a few small areas of the moderately well drained Croswell soils in narrow drainageways. Also included are a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher; a few areas where dolomitic limestone bedrock is within 60 inches of the surface; and a few where slopes are short and more than 6 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is rapid, and available water capacity is low. This soil is droughty and subject to soil blowing. Runoff is slow or very slow in cultivated areas. Organic-matter content is moderately low, and tilth is good.

Most areas are farmed or pastured. The potential is poor for cultivated crops and pasture, fair for woodland, and good for most engineering uses.

Because of droughtiness and a severe hazard of soil blowing, this soil is poorly suited to cultivated crops. It has potential, however, as irrigated cropland. Crop residue management, winter cover crops, and field windbreaks help to prevent excessive soil blowing. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing only a limited number of pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazed pastures are subject to soil blowing. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

Although not naturally forested, this soil is suitable as woodland. Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because permeability is rapid. This soil is suitable as a site for buildings and local roads and streets.

Capability subclass IVs; woodland suitability subclass 3s.

LnA—Lino loamy fine sand, 0 to 3 percent slopes. This nearly level and undulating, somewhat poorly drained soil is in depressional areas on outwash plains and on stream terraces. Individual areas are irregularly shaped or long and narrow and generally are 5 to 40 acres in size.

Typically, the surface layer is very dark brown loamy fine sand about 4 inches thick. The subsoil is about 37 inches thick. It is yellowish brown, mottled loamy fine sand over pale brown, mottled fine sand. The underlying material to a depth of about 60 inches is reddish brown fine sand. In places the surface layer is loamy sand or fine sand. In some areas the subsoil is loamy sand or sand.

Included with this soil in mapping are a few areas of the somewhat excessively drained Menahga and Omega soils and moderately well drained Croswell soils on convex slopes. Also included are a few areas of the poorly drained and very poorly drained Newson soils in shallow depressions and narrow drainageways and small areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 2 to 10 percent of the unit.

Permeability is rapid, and available water capacity is low. Runoff is very slow in cultivated areas. Organic-matter content is low. This soil is saturated within 2 to 4 feet of the surface during wet periods.

Most areas are woodland. A few are farmed or pastured. The potential is fair for woodland and poor for cultivated crops, pasture, and most engineering uses.

This soil is poorly suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches or open ditches is needed for dependable crop production. The soil is droughty, and in most years crop yields are limited as a result of the low available water capacity. If drained and cultivated, the soil is subject to soil blowing. Winter cover crops, crop residue management, and field windbreaks help to prevent excessive soil blowing.

This soil is suited to growing only a limited number of pasture grasses and legumes because it has a seasonal high water table and is droughty. Unless the soil is adequately drained, bluegrass is commonly grown. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves the survival rate during dry periods. Clear-cut or area-selection harvest methods reduce the risk of windthrow to the remaining trees. Suitable herbicides or mechanical removal controls the vegetation that competes with natural regeneration following harvest.

Because it has a seasonal high water table, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, helps to overcome this limitation. Building sites should be artificially drained. Providing suitable subbase material helps to prevent the damage to local roads and streets caused by frost action.

Capability subclass IVw; woodland suitability subclass 3s.

MaA—Magnor silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil occurs as plane to slightly concave areas on glacial moraines. It is subject to rare flooding. Individual areas are irregular in shape and generally are 5 to 35 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 2 inches thick. The next 7 inches is multicolored silt loam. The subsoil is about 14 inches thick. It is brown, mottled loam over reddish brown, mottled sandy loam. The underlying material to a depth of about 60 inches is reddish brown, mottled sandy loam. In places the subsoil is silt loam. In a few areas the underlying material has strata of loamy sand or sand.

Included with this soil in mapping are a few areas of the well drained Santiago and Amery soils and moderately well drained Freeon soils on convex slopes and a few small areas of the poorly drained Auburndale soils and poorly drained and very poorly drained Adolph soils in depressions and narrow drainageways. Also included are a few small areas where the slope is more than 2 percent. Included areas make up 5 to 10 percent of the unit.

Permeability is moderately slow, and available water capacity is moderate. Runoff is slow or very slow in cultivated areas. Organic-matter content is moderate, and tilth is good. This soil is saturated within 1 foot to 3 feet of the surface during wet periods. Some areas receive runoff from adjacent slopes and are likely to be ponded after heavy rains. Root penetration is somewhat restricted by compact glacial till below a depth of about 32 inches.

Many areas are farmed or pastured, and many remain wooded. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches and, in some areas, diversions is needed for dependable crop production. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. It should be artificially drained if a taprooted plant, such as alfalfa, is grown. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Competition from brush following harvest can interfere with natural regeneration. It can be reduced, however, by suitable herbicides or by mechanical removal of the brush.

Because of the seasonally perched water table and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, improves these absorption fields.

This soil lacks the strength needed to support dwellings and small commerical buildings, but strengthening or replacing the base material can overcome this limitation. Artificial drainage is needed on building sites. In some areas diversions are needed to protect the site from ponding. Strengthening or replacing the base material and providing suitable subbase material help to prevent the damage to local roads and streets resulting from low strength and frost action.

Capability subclass IIw; woodland suitability subclass 2o.

MaB—Magnor silt loam, 2 to 6 percent slopes. This undulating or gently sloping, somewhat poorly drained soil occurs as plane to slightly concave areas on glacial moraines. It is subject to rare flooding. Individual areas are irregular in shape and generally are 5 to 25 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 3 inches thick. The next 7 inches is multicolored silt loam. The subsoil is about 14 inches thick. It is brown, mottled loam over reddish brown, mottled sandy loam. The underlying material to a depth of about 60 inches is reddish brown, mottled sandy loam. In places the subsoil is silt loam. In a few areas the underlying material has strata of loamy sand or sand.

Included with this soil in mapping are a few areas of the well drained Santiago and Amery soils and moderately well drained Freeon soils on convex slopes and a few small areas of the poorly drained Auburndale soils and poorly drained and very poorly drained Adolph soils in depressions and narrow drainageways. Also included are a few areas where slopes are short and more than 6 percent and a few where they are less than 2 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is moderate. Runoff is slow in cultivated areas. Organic-matter content is moderate, and tilth is good. This soil is saturated within 1 foot to 3 feet of the surface during wet periods. Some areas receive runoff fom adjacent slopes and are likely to be ponded after heavy rains. Root penetration is somewhat restricted by compact glacial till below a depth of about 32 inches.

Many areas are farmed or pastured, and many remain wooded. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches and, in some areas, diversions is needed for dependable crop production. If cultivated crops are grown, erosion is a hazard. In areas where slopes are long and uniform, contour stripcrops, terraces, and grassed waterways help to control erosion, but they should not restrict surface drainage and thus increase the wetness. In areas where slopes are short and irregular, a proper crop rotation and minimum tillage are the best methods of controlling erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. It should be artificially drained if a taprooted plant, such as alfalfa, is grown. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Competition from brush following harvest can interfere with natural regeneration. It can be reduced, however, by suitable herbicides or by mechanical removal of the brush.

Because of the seasonally perched water table and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, improves these absorption fields.

This soil lacks the strength needed to support dwellings and small commercial buildings, but strengthening or replacing the base material can overcome this limitation. Artificial drainage is needed on building sites. In some areas diversions are needed to protect the site from ponding. Strengthening or replacing the base material and providing suitable subbase material help to prevent the damage to local roads and streets resulting from low strength and frost action.

Capability subclass IIe; woodland suitability subclass 2o.

Mk—Markey muck. This nearly level, very poorly drained soil is in bogs and depressional areas on glacial outwash plains and stream terraces. It is subject to frequent flooding. Individual areas are irregular in shape and generally are 3 to 20 acres in size.

Typically, the organic layer is black and very dark gray muck about 35 inches thick. The underlying material to a depth of about 60 inches is grayish brown sand. In places a layer of moss peat 1 inch to 4 inches thick is at the surface. In some areas thin layers of mucky peat are in the organic part.

Included with this soil in mapping are a few small areas of the poorly drained and very poorly drained sandy Newson soils in slightly higher positions; a few areas of Rifle and Seelyeville soils, which have an organic layer more than 51 inches thick; and small areas of the wet Fluvaquents adjacent to streams. Also included are a few areas that are very strongly acid or extremely acid. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the organic layer and rapid in the underlying mineral material. This soil is saturated within a foot of the surface most of the year.

Most areas remain in wetland vegetation. The potential is poor for cultivated crops, pasture, and most engineering uses and fair for woodland.

Because it has a high water table and is subject to flooding, this soil is generally unsuited to growing corn and small grain and to grasses and legumes for forage. If adequately drained, protected against flooding, and otherwise intensively managed, however, it has potential for growing some specialty crops. If drained and cultivated, it is subject to soil blowing and subsidence. The number of frost-free days per growing season is less on this soil than on adjacent upland soils because of cold air drainage.

Because of the high water table, the generally low natural fertility, and the flooding, this soil generally is unsuited to growing many of the pasture grasses and legumes. Unless the soil is adequately drained, reed canarygrass is the only suitable species. Low strength restricts the use of machinery and grazing.

This soil is suited to trees used for wood products. Wetness and the high water table during the planting season limit reforestation to natural regeneration. Harvesting with heavy equipment is restricted to periods when the ground is frozen. Clear-cut or area-selection harvest methods prevent serious windthrow of the remaining trees. Suitable herbicides or mechanical removal controls the brush that competes with natural regeneration.

This soil is generally unsuitable as a site for septic tank absorption fields and for dwellings and small commercial buildings because of the high water table, the flooding, and the low strength. It lacks the strength needed to support vehicular traffic, but replacing the organic layer with suitable base material can overcome this limitation. Roads should be constructed so that they do not restrict the natural drainage. Restricting the drainage could increase the wetness and destroy the productivity of the soil as woodland.

Capability subclass IVw, drained, and VIw, undrained; woodland suitability subclass 3w.

MnB—Menahga loamy sand, 1 to 6 percent slopes. This nearly level and undulating, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 50 acres in size.

Typically, the surface layer is black loamy sand about 1 inch thick. The subsurface layer is dark grayish brown loamy sand about 4 inches thick. The subsoil is dark yellowish brown and brown loamy sand and sand about 30 inches thick. The underlying material to a depth of about 60 inches is brown sand. In places the surface layer is loamy fine sand or sandy loam. In some areas the underlying material is gravelly sand. In cultivated areas plowing has mixed the subsurface layer and part of the subsoil with the surface layer.

Included with this soil in mapping are small areas of the moderately well drained Croswell soils and somewhat poorly drained Lino soils in shallow depressions and narrow drainageways. Also included are a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 2 to 10 percent of the unit.

Permeability is rapid, and available water capacity is low. Runoff is slow in cultivated areas. Organic-matter content is low. This soil is droughty and subject to soil blowing.

Many areas remain wooded or are pastured. Some are farmed. The potential is poor for cultivated crops and pasture, fair for woodland, and good for most engineering uses.

This soil is poorly suited to growing corn and small grain and to grasses and legumes for forage. It is droughty, and in most years crop yields are limited as a result of the low available water capacity. Some areas have potential as irrigated cropland. Winter cover crops, crop residue management, and field windbreaks help to prevent excessive soil blowing. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing only a limited number of pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazed pastures are subject to soil blowing. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because permeability is rapid. The soil is suited as a site for buildings and local roads and streets.

Capability subclass IVs; woodland suitability subclass 3s.

MnC—Menahga loamy sand, 6 to 12 percent slopes. This rolling, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 30 acres in size.

Typically, the surface layer is black loamy sand about 1 inch thick. The subsurface layer is dark grayish brown loamy sand about 3 inches thick. The subsoil is dark yellowish brown and brown loamy sand and sand about

25 inches thick. The underlying material to a depth of about 60 inches is brown sand. In places the surface layer is loamy fine sand or sandy loam. In some areas the underlying material is gravelly sand. In cultivated areas plowing has mixed the subsurface layer and part of the subsoil with the surface layer.

Included with this soil in mapping are small areas of the moderately well drained Croswell soils and somewhat poorly drained Lino soils in shallow depressions and narrow drainageways and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 12 percent and a few where they are less than 6 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is rapid, and available water capacity is low. Runoff is slow in cultivated areas. Organic-matter content is low. This soil is droughty and subject to erosion and soil blowing.

Many areas remain wooded or are pastured. Some areas are farmed. The potential is poor for cultivated crops and pasture and fair for woodland and most engineering uses.

This soil is generally unsuited to growing corn and small grain and to grasses and legumes for forage. It is droughty, and in most years crop yields are limited as a result of the low available water capacity. Some areas have potential as irrigated cropland. A proper crop rotation helps to prevent excessive erosion. Winter cover crops, crop residue management, and field windbreaks help to prevent excessive soil blowing. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing only a limited number of pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazed pastures are subject to erosion and soil blowing. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent, however, can pollute ground water because permeability is rapid. Because of the slope, land shaping generally is needed on building sites and cutting and filling generally are needed on sites for local roads and streets. The less sloping included areas are better building sites. Stabilizing road cuts is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations.

Capability subclass VIs; woodland suitability subclass 3s.

MnD—Menahga loamy sand, 12 to 25 percent slopes. This hilly and very hilly, somewhat excessively drained soil is on outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 40 acres in size.

Typically, the surface layer is black loamy sand about 1 inch thick. The subsurface layer is dark grayish brown loamy sand about 2 inches thick. The subsoil is about 22 inches thick. It is dark yellowish brown loamy sand over brown sand. The underlying material to a depth of about 60 inches is brown sand. In places the surface layer is loamy fine sand or sandy loam. In some areas the underlying material is gravelly sand. In cultivated areas plowing has mixed the subsurface layer and part of the subsoil with the surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Lino soils and poorly drained and very poorly drained Newson soils in shallow depressions and narrow drainageways and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 25 percent and a few where they are less than 12 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is rapid, and available water capacity is low. Organic-matter content also is low. This soil is droughty and subject to erosion and soil blowing.

Most areas are woodland. The potential is poor for cultivated crops, pasture, and most engineering uses and fair for woodland.

Because it is droughty and subject to erosion and soil blowing, this soil is generally unsuitable as cropland. It is suited to growing only a limited number of pasture grasses and legumes. As a result of the droughtiness, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazed pastures are subject to erosion and soil blowing. Proper stocking rates and pasture rotations help to keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Planting trees on the contour and carefully locating skid roads during harvest help to control erosion and simplify the use of equipment. Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

Because of the slope, this soil is poorly suited to septic tank absorption fields. This limitation can be overcome, however, by land shaping or avoided by selecting a less sloping included area. The effluent can pollute ground water because permeability is rapid.

As a result of the slope, land shaping generally is needed on building sites and extensive cutting and filling on sites for local roads and streets. Stabilizing road cuts is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations.

Capability subclass VIIs; woodland suitability subclass 3s.

MoB—Mora loam, 1 to 4 percent slopes. This nearly level and undulating, somewhat poorly drained soil occurs as plane or slightly concave areas on glacial moraines. Individual areas are irregular in shape and generally are 2 to 15 acres in size. In most areas scattered stones are on the surface.

Typically, the surface layer is very dark brown loam about 3 inches thick. The subsurface layer is brown, mottled loam about 8 inches thick. The next 11 inches is brown, mottled sandy loam. The subsoil is brown and reddish brown, mottled sandy loam about 11 inches thick. The underlying material to a depth of about 60 inches is reddish brown sandy loam. In places the surface layer is sandy loam or silt loam. In some areas the underlying material has strata of loamy sand or sand.

Included with this soil in mapping are a few areas of the well drained Amery soils on convex slopes and a few areas of the poorly drained and very poorly drained Adolph soils in small depressions and narrow drainageways. Also included are a few areas where slopes are short and more than 4 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is moderate. Runoff is slow in cultivated areas. Organic-matter content is moderate, and tilth is good. This soil is saturated within 1 foot to 3 feet of the surface during wet periods. Root penetration is somewhat restricted by compact glacial till below a depth of about 27 inches.

Many areas are farmed or pastured, and many remain wooded. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface ditches and, in some areas, diversions and grassed waterways is needed for dependable crop production. A proper crop rotation and minimum tillage help to control erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. It should be artificially drained if a taprooted plant, such as alfalfa, is grown. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Competition from brush following harvest can interfere with natural regeneration. It can be reduced, however, by suitable herbicides or by mechanical removal of the brush.

Because it has a seasonally perched water table and is moderately slowly permeable, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, improves these absorption fields. Building sites should be artificially drained. Providing suitable subbase material helps to prevent the damage to local roads and streets caused by frost action.

Capability subclass IIe; woodland suitability subclass 2o.

Ns—Newson loamy fine sand. This nearly level, poorly drained and very poorly drained soil is in depressional areas on outwash plains and low stream terraces. It is subject to occasional flooding. Individual areas are irregularly shaped or long and narrow and generally are 5 to 50 acres in size.

Typically, the surface layer is very dark gray loamy fine sand about 8 inches thick. The subsoil is grayish brown, mottled loamy fine sand about 16 inches thick. The underlying material to a depth of about 60 inches is light brown, mottled fine sand. In places the surface layer is sand, mucky sand, loamy sand, or mucky loamy sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Lino soils on concave slopes, a few areas of the very poorly drained organic Markey soils in small depressions, and a few areas of the wet Fluvaquents in drainageways or adjacent to streams. Also included are a few areas where the surface layer is muck and a few where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 2 to 10 percent of the unit.

Permeability is rapid, and available water capacity is low. This soil is saturated within a foot of the surface during wet periods unless it is drained. The roots of some plants are restricted by the high water table.

Most areas are woodland. The potential is poor for cultivated crops, pasture, woodland, and most engineering uses.

Because it has a high water table and is droughty, this soil is poorly suited to growing corn and small grain and to grasses and legumes for forage. Open drainage ditches and protection against flooding are needed if cultivated crops are grown. If drained and cultivated, the soil is very droughty and is subject to soil blowing. Some areas have potential as irrigated cropland. Winter cover crops, crop residue management, and field windbreaks help to prevent excessive soil blowing. This excessively wet soil warms up slowly in spring. The number of frost-free days per growing season is less on this soil than on adjacent soils because of cold air drainage.

This soil is poorly suited to growing many of the pasture grasses and legumes because of the high water table and the droughtiness. Unless the soil is adequately drained, bluegrass is commonly grown. Even under good pasture management, yields are generally low.

This soil is poorly suited as woodland. Trees grow slowly and tend to have poor form. Because the soil is wet, they generally should be planted on prepared ridges if natural regeneration is unreliable. Selection of large, vigorous nursery stock helps to avoid a high mortality rate. Harvest is frequently limited to periods when the ground is frozen. Clear-cut or group-selection harvest methods reduce the danger of windthrow to the remaining trees. Suitable herbicides or mechanical removal controls competing vegetation, which interferes with natural regeneration.

Because of the high water table and the flooding, this soil is generally unsuited to septic tank absorption fields. Sites for dwellings or small commercial buildings should be artificially drained and protected against flooding. Sites for local roads or streets should be drained.

Capability subclass IVw; woodland suitability subclass 4w.

NyA—Nymore fine sand, 0 to 3 percent slopes. This nearly level and undulating, somewhat excessively drained soil is on broad outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 50 acres in size.

Typically, the surface layer is dark brown fine sand about 8 inches thick. The subsoil is dark brown and brown fine sand about 30 inches thick. The underlying material to a depth of about 60 inches is strong brown, mottled fine sand. In places the surface layer is loamy sand or loamy fine sand. In some areas the underlying material is coarse sand or gravelly sand.

Included with this soil in mapping are a few small areas of the moderately well drained Croswell and somewhat poorly drained Lino soils in shallow depressions and narrow drainageways and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 3 percent. Included areas make up 2 to 15 percent of the unit.

Permeability is rapid, and available water capacity is low. Organic-matter content is moderately low, and tilth is good. This soil is droughty and subject to soil blowing.

Many areas are woodland. Some are farmed. The potential is poor for cultivated crops and pasture, fair for woodland, and good for most engineering uses.

Because of droughtiness and a severe hazard of soil blowing, this soil is poorly suited to cultivated crops. It has potential, however, as irrigated cropland. Crop residue management, winter cover crops, and field windbreaks help to prevent excessive soil blowing. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing only a limited number of pasture grasses and legumes. Because the soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazed pastures are subject to soil blowing. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because permeability is rapid. The soil is also suited as a site for buildings and local roads and streets.

Capability subclass IVs; woodland suitability subclass 3s.

OgB—Omega fine sand, 2 to 6 percent slopes. This undulating, somewhat excessively drained soil is on broad outwash plains and stream terraces. Individual areas are irregular in shape and generally are 10 to 150 acres in size.

Typically, the surface layer is very dark brown fine sand about 2 inches thick. The subsoil is reddish brown fine sand about 25 inches thick. The underlying material to a depth of about 60 inches is yellowish red fine sand. In places the surface layer is loamy sand or loamy fine sand. In cultivated areas it is about 8 inches thick.

Included with this soil in mapping are a few areas of the moderately well drained Croswell and somewhat poorly drained Lino soils in small depressions and narrow drainageways. Also included are a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 2 to 5 percent of the unit.

Permeability is rapid, and available water capacity is low. Organic-matter content also is low. This soil is droughty and subject to soil blowing.

Most areas are woodland. The potential is poor for cultivated crops and pasture, fair for woodland, and good for most engineering uses.

Some areas formerly were cleared and used for growing small grain and forage crops, but most of these areas have reverted to woodland. This soil is poorly suited to cultivated crops and pasture because of droughtiness, low natural fertility, and a severe hazard of soil blowing. It has potential, however, as irrigated cropland.

This soil is suited to trees used for wood products. Most areas are managed for the production of jack pine pulpwood. Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because permeability is rapid. The soil is also suited as a site for buildings and local roads and streets.

Capability subclass IVs; woodland suitability subclass 3s.

OgC—Omega fine sand, 6 to 12 percent slopes. This rolling, somewhat excessively drained soil is on broad outwash plains and stream terraces. Individual areas are irregular in shape and generally are 10 to 150 acres in size.

Typically, the surface layer is very dark brown fine sand about 2 inches thick. The subsoil is reddish brown fine sand about 19 inches thick. The underlying material to a depth of about 60 inches is yellowish red fine sand. In places the surface layer is loamy sand or loamy fine sand. In cultivated areas it is about 8 inches thick.

Included with this soil in mapping are a few areas of the moderately well drained Croswell and somewhat poorly drained Lino soils in small depressions and narrow drainageways and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 12 percent and small areas where they are less than 6 percent. Included areas make up 2 to 5 percent of the unit.

Permeability is rapid, and available water capacity is low. Organic-matter content also is low. This soil is droughty and subject to soil blowing.

Most areas are woodland. The potential is poor for cultivated crops and pasture and fair for woodland and most engineering uses.

Some areas formerly were cleared and used for growing small grain and forage crops, but these areas have reverted to woodland. This soil is poorly suited to cultivated crops and pasture because of droughtiness, low natural fertility, and a severe hazard of soil blowing. It has potential, however, as irrigated cropland.

This soil is suited to trees used for wood products. Most areas are managed for the production of jack pine pulpwood. Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because permeability is rapid. Because of the slope, land shaping generally is needed on building sites and cutting and filling on sites for local roads and streets. The less sloping included areas are better building sites. Stabilizing road cuts is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations.

Capability subclass VIs; woodland suitability subclass 3s.

OgD—Omega fine sand, 12 to 20 percent slopes. This hilly, somewhat excessively drained soil is on broad outwash plains. Individual areas are irregular in shape and generally are 10 to 200 acres in size.

Typically, the surface layer is very dark brown fine sand about 2 inches thick. The subsoil is reddish brown fine sand about 17 inches thick. The underlying material to a depth of about 60 inches is yellowish red fine sand. In places the surface layer is loamy sand or loamy fine sand.

Included with this soil in mapping are a few areas of the somewhat poorly drained Lino soils and poorly drained and very poorly drained Newson soils in small depressions and narrow drainageways and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are a few areas where slopes are short and more than 20 percent and a few where they are less than 12 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is rapid, and available water capacity is low. Organic-matter content also is low. This soil is droughty and subject to erosion and soil blowing.

Most areas are woodland. The potential is poor for cultivated crops, pasture, and most engineering uses and fair for woodland.

This soil is generally unsuitable as cropland and pasture because it is droughty and is subject to erosion and soil blowing.

This soil is suited to trees used for wood products. Most areas are managed for the production of jack pine pulpwood. Planting trees on the contour and carefully locating skid roads during harvest help to control erosion. Carefully planting vigorous nursery stock improves the survival rate. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

Because it is hilly, this soil is poorly suited to septic tank absorption fields. This limitation can be overcome, however, by land shaping or avoided by selecting a less steep included area. The effluent can pollute ground water because permeability is rapid.

Because of the slope, land shaping generally is needed on building sites and extensive cutting and filling on sites for local roads and streets. Stabilizing road cuts is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations.

Capability subclass VIIs; woodland suitability subclass 3s.

Pg—Pits, gravel. This map unit consists of miscellaneous areas that have been radically altered by earthmoving equipment during the removal of sand or sand and gravel (fig. 9). Most areas are irregular in shape and 3 to 30 acres in size.

The soil material remaining after the sand and gravel outwash is excavated typically is sand or gravelly sand. It generally is very low in natural fertility and very droughty. Some areas have been excavated as far down as the water table.

This map unit has poor potential for cultivated crops, pasture, woodland, and most engineering uses. The main concern of management is reclamation of the area after the sand and gravel deposits have been excavated. Land shaping and additions of suitable topsoil enable most areas to support a plant cover.

Capability subclass VIIIs; not assigned to a woodland suitability subclass.

PvA—Plover fine sandy loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on glacial lake plains and terraces. Individual areas are irregular in shape and generally are 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 10 inches thick. The subsurface layer is brown, mottled fine sandy loam about 3 inches thick. The next 5 inches is a mixture of the subsoil and the subsurface layer. The subsoil is dark brown, mottled fine sandy loam about 14 inches thick. The underlying material to a depth of about 60 inches is strong brown, mottled, stratified silt, loamy fine sand, and fine sand. In places the surface layer is loam or sandy loam.

Included with this soil in mapping are small areas of the well drained Alban soils on convex slopes and a few areas of the poorly drained Barronett soils or the Barronett Variant in small depressions and drainageways. Also included are a few small areas where the slope is more than 3 percent. Included areas make up 2 to 12 percent of the unit.

Permeability is moderate, and available water capacity is high. Organic-matter content is moderate, and tilth is good. This soil is saturated within 1 foot to 3 feet of the surface during wet periods.

Most areas are farmed. A few remain wooded or are pastured. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. Surface drainage ditches are needed for dependable crop production. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. It should be artificially drained if a taprooted plant, such as alfalfa, is grown. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because it has a seasonal high water table, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, helps to overcome this limitation. The soil lacks the strength needed to support dwellings and small commercial buildings, but strengthening or replacing the base material can overcome this limitation. Building sites should be artificially drained. Strengthening or replacing the base material and providing suitable subbase material help to prevent the damage to local roads and streets resulting from low strength and frost action.

Capability subclass IIw; woodland suitability subclass 2o.

PxA—Poskin silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is in shallow depressions and narrow drainageways on glacial outwash plains and stream terraces. It is subject to rare flooding. Individual areas are oval or long and narrow and generally are 2 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is pale brown, mottled silt about 4 inches thick. The next 10 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 17 inches thick. It is yellowish brown, mottled silt loam over strong brown, mottled sandy loam. The underlying material to a depth of about 60 inches is brown, mottled sand and gravel. In places the surface layer and the upper part of the subsoil are loam or sandy loam. In a few areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few small areas of the well drained Antigo and Rosholt soils and moderately well drained Brill soils on convex slopes and a few areas of the poorly drained and very poorly drained Warman Variant in small depressions. Also included are a few areas where, as a result of loamy or silty bands in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate in the upper silty material and very rapid in the underlying material. Available water capacity is moderate, and runoff is slow in cultivated areas. Organic-matter content is moderate, and tilth is good. This soil is saturated within 1 foot to 3 feet of the surface during wet periods unless it is drained. Some areas receive runoff from adjacent slopes and are likely to be ponded after heavy rains.

Most areas are farmed. A few remain wooded or are pastured. The potential is good for cultivated crops, pasture, and woodland and poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. An artificial drainage system of surface or open ditches, and in some areas, diversions is needed for dependable crop production. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

This soil is suited to growing many of the pasture grasses and legumes. It should be artificially drained if a taprooted plant, such as alfalfa, is grown. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because it has a seasonal high water table, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, helps to overcome this limitation. The soil lacks the strength needed to support dwellings and small commercial buildings, but strengthening or replacing the base material can overcome this limitation. Artificial drainage is needed on building sites. In some areas diversions are needed to protect the site from ponding. Strengthening or replacing the base material and providing suitable subbase material help to prevent the damage to local roads and streets resulting from low strength and frost action.

Capability subclass IIw; woodland suitability subclass 2o.

Rf—Rifle muck. This nearly level, very poorly drained soil is in bogs and depressional areas on glacial moraines, lake basins, and outwash plains. It is subject to frequent flooding. Individual areas are irregular in shape and generally are 10 to 200 acres in size.

Typically, the organic layer to a depth of about 60 inches is black and dark reddish brown muck and dark brown mucky peat. In places a layer of moss peat 1 inch to 4 inches thick is at the surface. In some areas no mucky peat is in the organic layer.

Included with this soil in mapping are small areas of mineral soils on convex knolls and small areas of Cathro and Markey soils, which have mineral soil layers within 50 inches of the surface. Also included are small areas of the wet Fluvaquents adjacent to streams and a few areas that are very strongly acid or extremely acid. Included areas make up 2 to 10 percent of the unit.

Permeability is moderately rapid. This soil is saturated within a foot of the surface most of the year.

Most areas remain in wetland vegetation. The potential is poor for cultivated crops, pasture, and most engineering uses and fair for woodland.

This soil is generally unsuited to growing corn and small grain and to grasses and legumes for forage because of the high water table and the flooding. If adequately drained, protected against flooding, and otherwise intensively managed, however, it has potential for growing some specialty crops. If drained and cultivated, it is subject to soil blowing and subsidence. The number of frost-free days per growing season is less on this soil than on adjacent upland soils because of cold air drainage.

Because of the high water table, the generally low natural fertility, and the flooding, this soil is unsuited to growing many of the pasture grasses and legumes. Unless the soil is adequately drained, reed canarygrass is the only suitable species. The low strength restricts the use of machinery and grazing.

This soil is suited to trees used for wood products. Because the soil is wet and has a high water table during the planting season, reforestation is limited to natural regeneration. Harvesting with heavy equipment is restricted to periods when the ground is frozen. Clear-cut or area-selection harvest methods help to avoid serious windthrow of the remaining trees. Suitable herbicides or mechanical removal controls the brush that competes with natural regeneration.

This soil is generally unsuitable as a site for septic tank absorption fields and for dwellings and small commercial buildings because of the high water table, the flooding, and the low strength. It lacks the strength needed to support vehicular traffic, but replacing the organic layer with suitable base material can overcome this limitation. Roads should be constructed so that they do not restrict the natural drainage. Restricting drainage could increase the wetness and destroy productivity of the soil as woodland.

Capability subclass IVw, drained, and VIw, undrained; woodland suitability subclass 3w.

RoA—Rosholt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad glacial outwash plains and stream terraces. Individual areas are irregular in shape and generally are 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 7 inches thick. The next 12 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 11 inches thick. It is dark brown sandy loam over dark brown loamy coarse sand. The underlying material to a depth of about 60 inches is brown, dark brown, and strong brown, stratified coarse sand and fine gravel. In places the surface layer and subsurface layer are silt loam or sandy loam. In some areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few small areas of the moderately well drained Brill and somewhat poorly drained Cromwell Variant and Poskin soils on concave slopes and in shallow depressions. Also included are small areas where the slope is more than 2 percent and a few areas where, as a result of loamy or silty bands in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper loamy material and very rapid in the underlying material. Available water capacity is moderate. Organic-matter content also is moderate, and tilth is good.

Most areas are farmed. Only a few areas are pasture or woodland. The potential is good for cultivated crops, pasture, woodland, and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. Row crops can be grown year after year without excessive erosion. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. Crop yields are limited as a result of the moderate available water capacity.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because the underlying material is very rapidly permeable. Providing suitable subbase material helps to prevent the damage to local roads and streets caused by frost action.

Capability subclass IIs; woodland suitability subclass 2o.

RoB—Rosholt loam, 2 to 6 percent slopes. This undulating, well drained soil is on broad glacial outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 7 inches thick. The next 12 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 11 inches thick. It is dark brown sandy loam over dark brown loamy coarse sand. The underlying material to a depth of about 60 inches is brown, dark brown, and strong brown, stratified coarse sand and fine gravel. In places the surface layer and subsurface layer are silt loam or sandy loam. In some areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few small areas of the moderately well drained Brill and somewhat poorly drained Cromwell Variant and Poskin soils on concave slopes and in shallow depressions. Also included are a few areas where slopes are short and more than 6 percent and a few where, as a result of loamy or silty bands in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the upper loamy material and very rapid in the underlying material. Available water capacity is moderate. Organic-matter content also is moderate, and tilth is good.

Most areas are farmed. Only a few areas are pasture or woodland. The potential is good for cultivated crops, pasture, woodland, and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. In most areas row crops can be grown year after year without excessive soil loss if tillage is kept to a minimum. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. Crop yields are limited during dry periods as a result of the moderate available water capacity.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is suited to septic tank absorption fields. The effluent can pollute ground water, however, because the underlying material is very rapidly permeable. Providing suitable subbase material helps to prevent the damage to local roads and streets caused by frost action.

Capability subclass IIe; woodland suitability subclass 2o.

RoC2—Rosholt loam, 6 to 12 percent slopes, eroded. This rolling, well drained soil is on glacial outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 15 acres in size.

Typically, the surface layer is grayish brown loam about 7 inches thick. The next 10 inches is a mixture of the subsoil and the surface layer. The subsoil is about 11 inches thick. It is dark brown sandy loam over dark brown loamy coarse sand. The underlying material to a depth of about 60 inches is brown, dark brown, and strong brown, stratified coarse sand and fine gravel. In places the surface layer is silt loam or sandy loam. In uncultivated areas it overlies a brown loam subsurface layer about 6 inches thick. In some areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few small areas of the moderately well drained Brill and somewhat poorly drained Cromwell Variant and Poskin soils in shallow depressions and a few small areas of the somewhat excessively drained Chetek and Cromwell soils on short, convex slopes. Also included are a few areas where slopes are short and more than 12 percent, small areas where they are less than 6 percent, and few areas where, as a result of loamy or silty bands in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the upper loamy material and very rapid in the underlying material. Available water capacity is moderate. Runoff is medium in cultivated areas. Organic-matter content is low. Erosion has lowered the organic-matter content and the fertility level, decreased the capacity of the soil to retain water, and resulted in poorer tilth in the surface layer.

Most areas are farmed. A few are pasture or woodland. The potential is good for cultivated crops, pasture, woodland, and most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of further erosion is moderate. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. Minimum tillage, winter cover crops, and spring plowing help to reduce soil losses in row cropped areas. Returning crop residue to the soil or regularly adding other organic material improves tilth and fertility and increases the rate of water infiltration. Crop yields are limited during dry periods as a result of the moderate available water capacity.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competiton from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

This soil is moderately suited to septic tank absorption fields. The effluent can pollute ground water because the underlying material is very rapidly permeable. Providing suitable subbase material helps to prevent the damage to local roads and streets caused by frost action. Because of the slope, land shaping is needed on building sites. The less sloping included areas are better building sites.

Capability subclass IIIe; woodland suitability subclass 2o.

RoD—Rosholt loam, 12 to 20 percent slopes. This hilly, well drained soil is on glacial outwash plains and stream terraces. Individual areas are irregular in shape and generally are 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is brown loam about 5 inches thick. The next 8 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 11 inches thick. It is dark brown sandy loam over dark brown loamy coarse sand. The underlying material to a depth of about 60 inches is brown, dark brown, and strong brown, stratified coarse sand and fine gravel. In places the surface layer and subsurface layer are silt loam or sandy loam. In cultivated areas, which commonly are moderately eroded, plowing has mixed all of the subsurface layer with the surface layer. In some areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few small areas of the moderately well drained Brill and somewhat poorly drained Cromwell Variant and Poskin soils in shallow depressions and a few small areas of the somewhat excessively drained Chetek and Cromwell soils on short, convex slopes. Also included are a few areas where slopes are short and more than 20 percent, a few where they are less than 12 percent, and a few where, as a result of loamy or silty bands in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the upper loamy material and very rapid in the underlying material. Available water capacity is moderate. Runoff is rapid in cultivated areas. Organic-matter content is moderate, and tilth is good.

Many areas are pasture or woodland. Some are farmed. The potential is good for pasture and woodland, fair for cultivated crops, and poor for most engineering uses.

This soil is poorly suited to growing corn and small grain but is suited to growing grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is severe. In most areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation, minimum tillage, and spring plowing help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. Crop yields are limited during dry periods as a result of the moderate available water capacity.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The soil related problems of forest management are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion and improve equipment trafficability. Care in planting and selection of vigorous planting stock improve the survival rate on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because it is hilly, this soil is poorly suited to septic tank absorption fields. The less steep included areas can be used as absorption fields, but the effluent can pollute ground water because of very rapidly permeable underlying material.

The slope limits this soil as a site for dwellings and local roads and streets. Land shaping is needed on building sites. The less steep included areas are better building sites. Extensive cutting and filling is needed on sites for local roads and streets.

Capability subclass IVe; woodland suitability subclass 2r.

RpB—Rosholt-Cromwell complex, 2 to 6 percent slopes. This map unit consists of undulating, well drained and somewhat excessively drained soils on pitted outwash plains. Individual areas are irregular in shape and generally are 5 to 20 acres in size. They are 40 to 50 percent Rosholt soils and 30 to 40 percent Cromwell soils. The Rosholt soils are on plane or convex ridgetops and on concave side slopes. The Cromwell soils are on sharp slope breaks and convex side slopes. The two soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Rosholt soil has a surface layer of dark grayish brown loam about 7 inches thick. The subsurface layer is brown loam about 7 inches thick. The next 12 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 11 inches thick. It is dark brown sandy loam over dark brown loamy coarse sand. The underlying material to a depth of about 60 inches is brown, dark brown, and strong brown, stratified coarse sand and fine gravel. In places the surface layer and subsurface layer are silt loam or sandy loam. In some areas the underlying material contains little or no gravel.

Typically, the Cromwell soil has a surface layer of dark grayish brown sandy loam about 6 inches thick. The subsoil is about 25 inches thick. It is dark brown sandy loam over dark brown cobbly loamy sand and sand. The underlying material to a depth of about 60 inches is brown and dark brown sand. In uncultivated areas the surface layer overlies a dark brown sandy loam subsurface layer about 2 inches thick. In places the surface layer is loam or loamy sand. In some areas the upper part of the subsoil is loamy sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Cromwell Variant and Poskin soils in shallow depressions and narrow drainageways. Also included are a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher; areas where slopes are short and more than 6 percent; and a few areas where they are less than 2 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the upper loamy material of the Rosholt and Cromwell soils, very rapid in the underlying material of the Rosholt soil, and rapid in the underlying material of the Cromwell soil. Available water capacity is moderate in the Rosholt soil and low in the Cromwell soil.

Most areas are farmed. Many remain wooded or are pastured. The potential is good for cultivated crops, pasture, woodland, and most engineering uses.

These soils are suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. On the Cromwell soil, which is droughty and has low available water capacity, crop yields are limited in most years. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

These soils are suited to growing many of the pasture grasses and legumes. Because the Cromwell soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. Carefully planting vigorous nursery stock improves the survival rate during dry periods. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

These soils are suited to septic tank absorption fields. The effluent can pollute ground water, however, because the underlying material is rapidly or very rapidly permeable. The soils are suitable as sites for buildings and local roads and streets. Providing suitable subbase material in the areas of Rosholt soil helps to prevent the damage to local roads and streets caused by frost action.

Capability subclass IIIe; Rosholt soil in woodland suitability subclass 2o, Cromwell soil in woodland suitability subclass 2d.

RpC—Rosholt-Cromwell complex, 6 to 12 percent slopes. This map unit consists of rolling, well drained and somewhat excessively drained soils on pitted outwash plains. Individual areas are irregular in shape and generally are 5 to 40 acres in size. They are 35 to 50 percent Rosholt soils and 35 to 45 percent Cromwell soils. The Rosholt soils are on plane or convex ridgetops and on concave side slopes. The Cromwell soils are on sharp slope breaks and convex side slopes. The two soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Rosholt soil has a surface layer of very dark grayish brown loam about 3 inches thick. The subsurface layer is brown loam about 9 inches thick. The next 12 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 11 inches thick. It is dark brown sandy loam over dark brown loamy coarse sand. The underlying material to a depth of about 60 inches is brown, dark brown, and strong brown, stratified coarse sand and fine gravel. In places the surface layer and subsurface layer are silt loam or sandy loam. In some areas the underlying material contains little or no gravel.

Typically, the Cromwell soil has a surface layer of black sandy loam about 1 inch thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is about 25 inches thick. It is dark brown sandy loam over dark brown cobbly loamy sand and sand. The underlying material to a depth of about 60 inches is brown and dark brown sand. In cultivated areas, many of which are eroded, plowing has mixed all of the subsurface layer and part of the subsoil with the surface layer. In places the surface layer is loam or loamy sand. In some areas the upper part of the subsoil is loamy sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Cromwell Variant and Poskin soils in shallow depressions and narrow drainageways and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are areas where slopes are short and more than 12 percent and a few areas where they are less than 6 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the upper loamy material of the Rosholt and Cromwell soils, very rapid in the underlying material of the Rosholt soil, and rapid in the underlying material of the Cromwell soil. Available water capacity is moderate in the Rosholt soil and low in the Cromwell soil.

Most areas remain wooded or are pastured. Some are farmed. The potential is good for pasture and woodland and fair for cultivated crops and most engineering uses.

These soils are suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. Minimum tillage and winter cover crops in combination with spring plowing help to reduce soil loss in row cropped areas. On the Cromwell soil, which is droughty and has low available water capacity, crop yields are limited in most years. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

These soils are suited to growing many of the pasture grasses and legumes. Because the Cromwell soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. Carefully planting vigorous nursery stock improves the survival rate during dry periods. Suitable herbicides or mechanical removal of brush controls competing vegetation, which can interfere with natural regeneration following harvest.

These soils are suited to septic tank absorption fields. The effluent can pollute ground water, however, because permeability is rapid or very rapid in the underlying material.

Because of the slope, land shaping generally is needed on building sites and cutting and filling on sites for local roads and streets. The less sloping included areas are better building sites. Stabilizing road cuts in the areas of Cromwell soil is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations. Providing suitable subbase material helps to prevent the road damage caused by frost action on the Rosholt soil.

Capability subclass IVe; Rosholt soil in woodland suitability subclass 2o, Cromwell soil in woodland suitability subclass 2d.

RpD—Rosholt-Cromwell complex, 12 to 20 percent slopes. This map unit consists of hilly, well drained and somewhat excessively drained soils on pitted outwash plains. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 5 to 50 acres in size. They are 30 to 40 percent Rosholt soils and 35 to 45 percent Cromwell soils. The Rosholt soils are on plane or convex ridgetops and on concave side slopes. The Cromwell soils are on sharp slope breaks and convex side slopes. The two soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Rosholt soil has a surface layer of very dark grayish brown loam about 3 inches thick. The subsurface layer is brown loam about 5 inches thick. The next 8 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 11 inches thick. It is dark brown sandy loam over dark brown loamy coarse sand. The underlying material to a depth of about 60 inches is brown, dark brown, and strong brown, stratified coarse sand and fine gravel. In places the surface layer and subsurface layer are silt loam or sandy loam. In cultivated areas, many of which are eroded, plowing has mixed the subsurface layer and part of the subsoil with the surface layer. In some areas the underlying material contains little or no gravel.

Typically, the Cromwell soil has a surface layer of black sandy loam about 1 inch thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is about 25 inches thick. It is dark brown sandy loam over dark brown cobbly loamy sand and sand. The underlying material to a depth of about 60 inches is brown and dark brown sand. In cultivated areas, many of which are eroded, plowing has mixed the subsurface layer and part of the subsoil with the surface layer. In places the surface layer is loam or loamy sand. In some areas the upper part of the subsoil is loamy sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Cromwell Variant and Poskin soils and poorly drained and very poorly drained Warman Variant in shallow depressions and narrow drainageways, a few areas of the excessively drained Emmert soils on small kames and eskers, and a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Also included are areas where the slope is more than 20 percent and a few areas where it is less than 12 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the upper loamy material of the Rosholt and Cromwell soils, very rapid in the underlying material of the Rosholt soil, and rapid in the underlying material of the Cromwell soil. Available water capacity is moderate in the Rosholt soil and low in the Cromwell soil.

Most areas are wooded or pastured. The potential is good for woodland, fair for pasture, and poor for cultivated crops and most engineering uses.

Because of a severe hazard of erosion and because of droughtiness in the Cromwell soil, these soils are generally unsuited to growing corn and small grain. They are suited, however, to growing grasses and legumes for forage. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

These soils are suited to growing many of the pasture grasses and legumes. Because the Cromwell soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. Planting trees on the contour and carefully locating skid roads during harvest help to control erosion. Care in planting and selection of vigorous nursery stock reduce the mortality rate. Clear-cut or area-selection harvest methods reduce the risk of windthrow of the remaining trees. Suitable herbicides or mechanical removal controls the plants that compete with natural regeneration following harvest.

Because of the slope, these soils are poorly suited to septic tank absorption fields. This limitation can be overcome, however, by land shaping or avoided by selecting a less steep included area. The effluent can pollute ground water because permeability is rapid or very rapid in the underlying material.

Because of the slope, land shaping is generally needed on building sites. The less steep included areas are better building sites. On sites for local roads and streets, extensive cutting and filling generally is needed because slopes are hilly and irregular. Stabilizing road cuts in the areas of Cromwell soil is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations. In places these soils are an important source of sand and gravel for construction and road building.

Capability subclass VIe; Rosholt soil in woodland suitability subclass 2r, Cromwell soil in woodland suitability subclass 2d.

RpE—Rosholt-Cromwell complex, 20 to 30 percent slopes. This map unit consists of very hilly, well drained and somewhat excessively drained soils on pitted outwash plains. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 5 to 50 acres in size. They are 25 to 40 percent Rosholt soils and 35 to 55 percent Cromwell soils. The Rosholt soils are on plane or convex ridgetops and on concave side slopes. The Cromwell soils are on sharp slope breaks and convex side slopes. The two soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Rosholt soil has a surface layer of very dark grayish brown loam about 3 inches thick. The subsurface layer is brown loam about 5 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 10 inches thick. It is dark brown sandy loam over dark brown loamy coarse sand. The underlying material to a depth of about 60 inches is brown, dark brown, and strong brown, stratified coarse sand and fine gravel. In places the surface layer and subsurface layer are silt loam or sandy loam. In some areas the underlying material contains little or no gravel.

Typically, the Cromwell soil has a surface layer of black sandy loam about 1 inch thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is about 25 inches thick. It is dark brown sandy loam over dark brown cobbly loamy sand and sand. The underlying material to a depth of about 60 inches is brown and dark brown sand. In places the surface layer is loam or loamy sand. In some areas the upper part of the subsoil is loamy sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Cromwell Variant and Poskin soils and poorly drained and very poorly drained Warman Variant in shallow depressions and narrow drainageways and small areas of the excessively drained Emmert soils on kames and eskers. Also included are small areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher; areas where the slope is more than 30 percent; and a few areas where it is less than 20 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the upper loamy material of the Rosholt and Cromwell soils, very rapid in the underlying material of the Rosholt soil, and rapid in the underlying material of the Cromwell soil. Available water capacity is moderate in the Rosholt soil and low in the Cromwell soil.

Most areas are woodland. The potential is poor for cultivated crops and most engineering uses and fair for woodland and pasture.

These soils are generally unsuited to growing corn and small grain because of the slope, a severe hazard of erosion, and the droughtiness of the Cromwell soil. They are suited to growing many of the pasture grasses and legumes. Because the Cromwell soil is droughty, a deep-rooted plant, such as alfalfa, generally is more productive than other species. The slope hinders some farm machinery. Bluegrass is commonly grown in areas where machinery cannot be used and pasture cannot be renovated by chemicals. Overgrazing can result in surface compaction, erosion, and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. Planting trees on the contour and carefully locating skid roads during harvest help to control erosion. Care in planting and selection of vigorous nursery stock reduce the mortality rate. Clear-cut or area-selection harvest methods reduce the risk of windthrow of the remaining trees. Suitable herbicides or mechanical removal controls the plants that compete with natural regeneration following harvest.

Because of the slope, these soils are generally unsuited to septic tank absorption fields. This limitation can be overcome, however, by land shaping. The effluent can pollute ground water because permeability is rapid or very rapid in the underlying material.

Because of the slope, land shaping is needed on building sites. On sites for local roads and streets, extensive cutting and filling is needed because slopes are very hilly and irregular. Stabilizing road cuts in areas of the Cromwell soil is difficult because cutbanks cave in and are low in natural fertility. Proper land shaping and additions of suitable topsoil, however, can overcome these limitations. In places the soils are an important source of sand and gravel for construction and road building.

Capability subclass VIIe; Rosholt soil in woodland suitability subclass 2r, Cromwell soil in woodland suitability subclass 2d.

RvB—Rosholt Variant silt loam, 2 to 6 percent slopes. This undulating, well drained, moderately deep soil is on bedrock-controlled glaciated uplands. Individual areas are irregular in shape and generally are 3 to 15 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsurface layer is light brownish gray silt about 1 inch thick. The next 8 inches is multicolored silt and silt loam. The subsoil is dark brown loam and clay loam about 4 inches thick. Dolomitic limestone bedrock is at a depth of about 23 inches. In uncultivated areas the surface layer is thinner and the subsurface layer thicker. In some eroded areas plowing has mixed all of the subsurface layer and part of the subsoil with the surface layer.

Included with this soil in mapping are a few areas of Antigo and Rosholt soils, which do not have limestone bedrock within 60 inches of the surface. Also included are a few areas where bedrock crops out on convex slopes and a few areas where slopes are short and more than 6 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate, and available water capacity is low. Runoff is slow in cultivated areas. Organic-matter content is moderate, and tilth is good. Root penetration is restricted by the bedrock at a depth of 20 to 40 inches.

Most areas are farmed or pastured. Some are wooded. The potential is good for cultivated crops, pasture, and woodland and fair or poor for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, measures that prevent excessive erosion are needed. A proper crop rotation, contour farming, and spring plowing help to prevent excessive soil losses. In most areas row crops can be grown year after year without excessive soil loss if tillage is kept to a minimum. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration. Crop yields are limited in most years as a result of the low available water capacity. In some areas the bedrock outcrops interfere with cultivation.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because of the depth to bedrock, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material, however, helps to overcome this limitation. The soil is moderately well suited as a site for dwellings and local roads and streets. Providing suitable base and subbase material helps to overcome shrinking and swelling, low strength, and frost action. Excavating for dwellings with basements is difficult because of the bedrock. The limestone under this soil is an important local source of agricultural lime.

Capability subclass IIe; woodland suitability subclass 2o.

SaB—Santiago silt loam, 1 to 6 percent slopes. This nearly level and undulating, well drained soil is on plane or convex ridgetops on glacial moraines. Individual areas are irregular in shape and generally are 5 to 35 acres in size.

Typically, the surface layer is very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 9 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 20 inches thick. It is yellowish brown silt loam over brown loam and sandy loam. The underlying material to a depth of about 60 inches is reddish brown sandy loam. In cultivated areas plowing has mixed the upper part of the subsurface layer with the surface layer. In some areas the subsoil is silt loam throughout. In a few areas the underlying material has bands of loamy sand or sand.

Included with this soil in mapping are small areas of the moderately well drained Freeon soils on concave slopes. Also included are small areas of the somewhat poorly drained Magnor soils and very poorly drained Adolph soils in shallow depressions and a few areas where slopes are short and more than 6 percent. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is moderate. Runoff is slow in cultivated areas. Organic-matter content is moderate, and tilth is good. Root penetration is somewhat restricted by compact glacial till below a depth of about 32 inches.

Many areas are farmed. Other areas remain wooded. The potential is good for cultivated crops, pasture, and woodland and fair for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is slight or moderate. In many areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Minimum tillage and winter cover crops in combination with spring plowing help to prevent excessive soil loss in row cropped areas. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or mechanical removal of the brush.

Because it is too slowly permeable in some areas, this soil is only moderately suited to septic tank absorption fields. Increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome this limitation. The soil lacks the strength needed to support dwellings and small buildings, but strengthening or replacing the base material can overcome this limitation. Providing suitable base and subbase material helps to prevent the damage to local roads and streets resulting from low strength and frost action.

Capability subclass IIe; woodland suitability subclass 2o.

SaC—Santiago silt loam, 6 to 12 percent slopes. This rolling, well drained soil is on plane or convex ridgetops on glacial moraines. Individual areas are irregular in shape and generally are 5 to 20 acres in size.

Typically, the surface layer is very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 8 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 20 inches thick. It is yellowish brown silt loam over brown loam and sandy loam. The underlying material to a depth of about 60 inches is reddish brown sandy loam. In cultivated areas, many of which are eroded, plowing has mixed most or all of the subsurface layer with the surface layer. In some areas the subsoil is silt loam throughout. In a few areas the underlying material has bands of loamy sand or sand.

Included with this soil in mapping are small areas of the moderately well drained Freeon soils on concave slopes and small areas of the somewhat poorly drained Magnor soils and very poorly drained Adolph soils in shallow depressions. Also included are a few areas where slopes are short and more than 12 percent and small areas where they are less than 6 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is moderate. Runoff is medium in cultivated areas. Organic-matter content is moderate, and tilth is good. Root penetration is somewhat restricted by compact glacial till below a depth of about 32 inches.

Some areas are farmed. Others remain wooded. The potential is good for cultivated crops, pasture, and woodland and fair for most engineering uses.

This soil is suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is moderate. In many areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. Minimum tillage and winter cover crops in combination with spring plowing help to prevent excessive soil loss in row cropped areas. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

Because it is too slowly permeable in some areas, this soil is only moderately suited to septic tank absorption fields. Increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome this limitation.

The slope limits this soil as a site for dwellings, but this limitation can be overcome by land shaping or avoided by selecting a less sloping included area. The soil lacks the strength needed to support dwellings and small commercial buildings, but this limitation can be overcome by strengthening or replacing the base material. Providing suitable base and subbase material helps to prevent the damage to local roads and streets resulting from low strength and frost action.

Capability subclass IIIe; woodland suitability subclass 2o.

SaD—Santiago silt loam, 12 to 20 percent slopes. This hilly, well drained soil is on the sides and convex tops of ridges on glacial moraines. Individual areas are irregular in shape and generally are 5 to 15 acres in size.

Typically, the surface layer is very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 20 inches thick. It is yellowish brown silt loam over brown loam and sandy loam. The underlying material to a depth of about 60 inches is reddish brown sandy loam. In cultivated areas, many of which are eroded, plowing has mixed most or all of the subsurface layer with the surface layer. In some areas the subsoil is silt loam throughout. In a few areas the underlying material has bands of loamy sand or sand.

Included with this soil in mapping are small areas of the moderately well drained Freeon soils on concave slopes and small areas of the somewhat poorly drained Magnor and very poorly drained Adolph soils in shallow depressions. Also included are a few areas where slopes are short and more than 20 percent and small areas where they are less than 12 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is moderate. Runoff is rapid in cultivated areas. Organic-matter content is moderate, and tilth is good. Root penetration is somewhat restricted by compact glacial till below a depth of about 32 inches.

Many areas remain wooded. Some are farmed. The potential is good for pasture and woodland, fair for cultivated crops, and poor for most engineering uses.

This soil is poorly suited to growing corn and small grain but is suited to growing grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is severe. A proper crop rotation helps to prevent excessive erosion. In many areas slopes are too short and irregular for stripcropping, terracing, or farming on the contour. Minimum tillage and winter cover crops in combination with spring plowing help to prevent excessive soil loss in row cropped areas. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth, improves fertility, and increases the rate of water infiltration.

This soil is suited to growing many of the pasture grasses and legumes. Overgrazing, however, causes surface compaction and poor tilth. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

This soil is suited to trees used for wood products. The soil related problems of forest management are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion. Care in planting and selection of vigorous planting stock improve seedling survival on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because it is too steep and in some areas too slowly permeable, this soil is poorly suited to septic tank absorption fields. A filtering mound of suitable material improves these absorption fields. The less steep included areas are better sites.

The slope limits this soil as a site for dwellings, but this limitation can be overcome by land shaping or avoided by selecting a less steep included area. On most sites for local roads and streets, extensive cutting and filling is needed. The soil lacks the strength needed to support dwellings and vehicular traffic, but strengthening or replacing the base material can overcome this limitation.

Capability subclass IVe; woodland suitability subclass 2r.

ScB—Santiago-Antigo silt loams, 2 to 6 percent slopes. This map unit consists of undulating, well drained soils on glacial moraines. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 5 to 30 acres in size. They are 45 to 55 percent Santiago soils and 25 to 35 percent Antigo soils. The Santiago soils are on plane or convex ridgetops and side slopes. The Antigo soils are typically on plane or concave slopes. The two soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Santiago soil has a surface layer of very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 9 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 20 inches thick. It is yellowish brown silt loam over brown loam and sandy loam. The underlying material to a depth of about 60 inches is reddish brown sandy loam. In cultivated areas plowing has mixed part of the subsurface layer with the surface layer. In some areas the underlying material has strata of loamy sand or sand.

Typically, the Antigo soil has a surface layer of very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 7 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 16 inches thick. It is dark yellowish brown silt loam over dark brown loam. The underlying material to a depth of about 60 inches is dark brown and reddish brown, stratified coarse sand and gravel and sand. In places, the silty mantle is thinner and depth to the underlying material is less than 32 inches. In some areas the underlying material contains little or no gravel. In cultivated areas plowing has mixed part of the subsurface layer with the surface layer.

Included with these soils in mapping are a few areas of the somewhat excessively drained Chetek and Cromwell soils on sharp slope breaks and small areas of the moderately well drained Brill and Freeon soils and somewhat poorly drained Magnor and Poskin soils on plane or concave slopes and in shallow depressions. Also included are areas where the slope is more than 6 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is moderate or moderately slow in the Santiago soil. It is moderate in the upper silty material of the Antigo soil and very rapid in the underlying material. In both soils available water capacity and organic-matter content are moderate. Root penetration in the Santiago soil is somewhat restricted by compact glacial till below a depth of about 32 inches.

Most areas are woodland. Some are farmed or pastured. The potential is good for cultivated crops, pasture, and woodland and fair for most engineering uses.

These soils are suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, erosion is a hazard. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. Minimum tillage and winter cover crops in combination with spring plowing help to control erosion in row cropped areas. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

These soils are suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

These soils are moderately suited to septic tank absorption fields. In some areas the Santiago soil is too slowly permeable, but increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome this limitation. Onsite investigation is needed in selecting suitable sites.

Both soils lack the strength needed to support buildings and vehicular traffic, but providing suitable base material can overcome this limitation. Adding suitable subbase material helps to prevent the damage to local roads and streets caused by frost action.

Capability subclass IIe; woodland suitability subclass 2o.

ScC—Santiago-Antigo silt loams, 6 to 12 percent slopes. This map unit consists of rolling, well drained soils on glacial moraines. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 5 to 70 acres in size. They are 45 to 55 percent Santiago soils and 25 to 35 percent Antigo soils. The Santiago soils are on plane or convex ridgetops and side slopes. The Antigo soils are typically on plane or concave slopes. The two soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Santiago soil has a surface layer of very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 9 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 20 inches thick. It is yellowish brown silt loam over brown loam and sandy loam. The underlying material to a depth of about 60 inches is reddish brown sandy loam. In cultivated areas, many of which are eroded, plowing has mixed the subsurface layer and part of the subsoil with the surface layer. In some areas the underlying material has strata of loamy sand or sand.

Typically, the Antigo soil has a surface layer of very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 7 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 16 inches thick. It is dark yellowish brown silt loam over dark brown loam. The underlying material to a depth of about 60 inches is dark brown and reddish brown, stratified coarse sand and sand and gravel. In places, the silty mantle is thinner and depth to the underlying material is less than 32 inches. In some areas the underlying material contains little or no gravel. In cultivated areas, many of which are eroded, plowing has mixed the subsurface layer and part of the subsoil with the surface layer.

Included with these soils in mapping are a few areas of the somewhat excessively drained Chetek and Cromwell soils on sharp slope breaks, small areas of the moderately well drained Brill and Freeon soils and somewhat poorly drained Magnor and Poskin soils on plane or concave slopes and in shallow depressions, and a few small areas of the very poorly drained Adolph, Cathro, and Seelyeville soils in deep depressions. Also included are areas where the slope is more than 12 percent and small areas where it is less than 6 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate or moderately slow in Santiago soil. It is moderate in the upper silty material of the Antigo soil and very rapid in the underlying material. In both soils available water capacity and organic-matter content are moderate. Root penetration in the Santiago soil is somewhat restricted by compact glacial till below a depth of about 32 inches.

Most areas are woodland. Some are farmed or pastured. The potential is good for cultivated crops, pasture, and woodland and fair or poor for most engineering uses.

These soils are suited to growing corn and small grain and to grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is moderate. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. Minimum tillage and winter cover crops in combination with spring plowing help to control erosion in row cropped areas. Wet depressions interfere with cultivation. Draining these depressions generally is difficult. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

These soils are suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The only soil related forest management problem is competition from brush following harvest. This competition can interfere with natural regeneration. It can be reduced by suitable herbicides or by mechanical removal of the brush.

These soils are moderately suited to septic tank absorption fields. In some areas the Santiago soil is too slowly permeable, but increasing the size of the absorption field or building a filtering mound of suitable material helps to overcome this limitation. Onsite investigation is needed in selecting suitable sites.

Both soils lack the strength needed to support buildings and vehicular traffic, but providing suitable base material can overcome this limitation. Land shaping is needed on building sites. The less sloping included areas are better building sites. Adding suitable subbase material helps to prevent the damage to local roads and streets caused by frost action.

Capability subclass IIIe; woodland suitability subclass 2o.

ScD—Santiago-Antigo silt loams, 12 to 20 percent slopes. This map unit consists of hilly, well drained soils on glacial moraines. Slopes are short and irregular, and depressions and small wet areas are common. Individual areas are irregular in shape and generally are 5 to 50 acres in size. They are 35 to 45 percent Santiago soils and 35 to 45 percent Antigo soils. The Santiago soils are on plane or convex ridgetops and side slopes. The Antigo soils are typically on concave slopes. The two soils are so intricately mixed or are in such small areas that mapping them separately is not practical.

Typically, the Santiago soil has a surface layer of very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 20 inches thick. It is yellowish brown silt loam over brown loam and sandy loam. The underlying material to a depth of about 60 inches is reddish brown sandy loam. In cultivated areas, many of which are eroded, plowing has mixed the subsurface layer and part of the subsoil with the surface layer. In some areas the underlying material has strata of loamy sand or sand.

Typically, the Antigo soil has a surface layer of very dark brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 7 inches thick. The next 6 inches is a mixture of the subsoil and the subsurface layer. The subsoil is about 16 inches thick. It is dark yellowish brown silt loam over dark brown loam. The underlying material to a depth of about 60 inches is dark brown and reddish brown, stratified coarse sand and sand and gravel. In places, the silty mantle is thinner and depth to the underlying material is less than 32 inches. In some areas the underlying material contains little or no gravel. In cultivated areas, many of which are eroded, plowing has mixed the subsurface layer and part of the subsoil with the surface layer.

Included with these soils in mapping are a few areas of the somewhat excessively drained Chetek and Cromwell soils on sharp slope breaks, small areas of the moderately well drained Brill and Freeon soils and somewhat poorly drained Magnor and Poskin soils on plane or concave slopes and in shallow depressions, and a few small areas of the very poorly drained Adolph, Cathro, and Seelyeville soils in deep depressions. Also included are areas where the slope is more than 20 percent and small areas where it is less than 12 percent. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate or moderately slow in the Santiago soil. It is moderate in the upper silty material of the Antigo soil and very rapid in the underlying material. In both soils available water capacity and organic-matter content are moderate. Root penetration in the Santiago soil is somewhat restricted by compact glacial till below a depth of about 32 inches.

Most areas are woodland. Some are farmed or pastured. The potential is good for pasture and woodland, fair for cultivated crops, and poor for most engineering uses.

These soils are poorly suited to growing corn and small grain but are suited to growing grasses and legumes for forage. If cultivated crops are grown, the hazard of erosion is severe. Slopes are too short and irregular for stripcropping, terracing, or farming on the contour. A proper crop rotation helps to prevent excessive soil loss. Minimum tillage and winter cover crops in combination with spring plowing help to control erosion in row cropped areas. Wet depressions interfere with cultivation. Draining these depressions generally is difficult. Returning crop residue to the soil or regularly adding other organic material helps to maintain good tilth and improves fertility.

These soils are suited to growing many of the pasture grasses and legumes. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, erosion, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The soil related problems of forest management are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion. Care in planting and selection of vigorous planting stock improve seedling survival on the steeper slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because slopes are hilly and in some areas the Santiago soil is too slowly permeable, these soils are poorly suited to septic tank absorption fields. A filtering mound of suitable material improves these absorption fields. The less steep included areas are better sites. Onsite investigation is needed in selecting suitable sites.

The slope limits these soils as sites for dwellings, but this limitation can be overcome by land shaping or avoided by selecting a less steep included area. On sites for local roads and streets, extensive cutting and filling generally is needed. The soils lack the strength needed to support dwellings and vehicular traffic, but strengthening or replacing the base material can overcome this limitation.

Capability subclass IVe; woodland suitability subclass 2r.

Se—Saprists and Aquents. These nearly level, very poorly drained organic and mineral soils are adjacent to lakes or streams, in sloughs and oxbows on flood plains, and in depressional areas on glacial moraines and outwash plains. They are subject to frequent flooding. Individual areas are irregular in shape and generally are 5 to 100 acres in size. The water table is at or above the surface during most of the year.

These soils have a wide range of profile characteristics. As a result, they cannot be classified at the series level. Saprists are organic soils, primarily mucks or mucky peats. The organic material ranges from about 1 1/2 to 5 or more feet in thickness. Aquents are mineral soils. They vary widely in color and texture and in thickness of individual layers.

Included with these soils in mapping are a few areas of poorly drained mineral soils on small islandlike knolls. Also included are a few areas of the poorly drained and very poorly drained, wet Fluvaquents adjacent to streams. Included areas make up 2 to 10 percent of the unit.

Most areas remain in wetland vegetation (fig. 10) and are used as wetland wildlife habitat. These soils have poor potential and generally are unsuitable for cultivated crops, pasture, woodland, and most engineering uses because of the high water table and the flooding. Providing adequate drainage and protection from floodwater is difficult.

These soils have good potential for wetland wildlife habitat. They provide a very important habitat for many species of wildlife, especially waterfowl and many furbearers.

Capability subclass VIIIw; woodland suitability subclass 6w.

Sm—Seelyeville muck. This nearly level, very poorly drained soil is in bogs and depressional areas on glacial moraines, lake basins, and outwash plains. It is subject to frequent flooding. Individual areas are irregular in shape and generally are 10 to 200 acres in size.

Typically, a thin layer of mucky peat is at the surface. Below this to a depth of about 60 inches is very dark brown, dark brown, and strong brown muck. In places a layer of moss peat 1 inch to 4 inches thick is at the surface. In some areas the layers of mucky peat are thicker.

Included with this soil in mapping are small areas of mineral soils on small convex knolls and small areas of Cathro and Markey soils, which have mineral soil layers within 50 inches of the surface. Also included are small areas of the wet Fluvaquents adjacent to streams and a few areas that are very strongly acid or extremely acid. Included areas make up 2 to 10 percent of the unit.

Permeability is moderately rapid, and available water capacity is very high. Organic-matter content also is very high. This soil is saturated within a foot of the surface most of the year.

Most areas remain in wetland vegetation (fig. 11). The potential is poor for cultivated crops, pasture, and most engineering uses and fair for woodland.

This soil is generally unsuited to growing corn and small grain and to grasses and legumes used for forage because of the high water table and the flooding. If adequately drained, protected from floodwater, and otherwise intensively managed, however, it has potential for some specialty crops. If drained and cultivated, it is subject to soil blowing and subsidence. The number of frost-free days per growing season is less on this soil than on adjacent upland soils because of cold air drainage.

Because of the high water table, the generally low natural fertility, and the flooding, this soil is generally unsuited to growing many of the pasture grasses and legumes. Unless the soil is adequately drained, reed canarygrass is the only suitable species. The low strength restricts grazing and the use of machinery.

This soil is suited to trees used for wood products. Because the soil is wet and has a high water table during the planting season, reforestation is restricted to natural regeneration. Harvesting with heavy equipment is limited to periods when the ground is frozen. Clear-cut or area-selection harvest methods help to avoid serious windthrow of the remaining trees. Suitable herbicides or mechanical removal controls the brush that competes with natural regeneration.

Because of the high water table, the flooding, and the low strength, this soil is generally unsuitable as a site for septic tank absorption fields and for dwellings and small commercial buildings. It lacks the strength needed to support vehicular traffic, but replacing the organic layer with suitable base material can overcome this limitation. Roads should be constructed so that they do not restrict the natural drainage. Restricting the drainage could increase the wetness and destroy the productivity of the soil as woodland.

Capability subclass IVw, drained, and VIw, undrained; woodland suitability subclass 3w.

Us—Udorthents, sandy. This map unit consists of steep and very steep, somewhat excessively drained soils on escarpments adjacent to lakes, streams, and stream terraces. Individual areas are long and narrow and generally are 5 to 25 acres in size. Slope ranges from 20 to 45 percent.

The color and thickness of individual layers vary widely. As a result, these soils cannot be classified at the series level. The surface layer is typically sand, loamy sand, or sandy loam. The subsoil and underlying material are dominantly sand, loamy sand, or gravelly sand.

Included with these soils in mapping are a few areas of the well drained loamy Udorthents and a few areas where bedrock is within 60 inches of the surface. Also included are a few areas where the slope is less than 20 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is rapid or very rapid. Available water capacity is low or very low.

Most areas are woodland. The potential is poor for cultivated crops, pasture, woodland, and most engineering uses.

Because of the slope, a severe hazard of erosion, and droughtiness, these soils are generally unsuited to cultivated crops. They are poorly suited to pasture grasses and legumes. Bluegrass is commonly grown in areas where slopes hinder farm machinery and where renovation by chemicals is not feasible. Overgrazing results in surface compaction and excessive erosion. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

These soils are poorly suited to woodland. Trees grow slowly and tend to have poor form. Planting trees on the contour and carefully locating skid roads reduces the risk of erosion. Carefully planting vigorous nursery stock helps to overcome a poor survival rate during dry periods.

Because they are steep and very steep, these soils are generally unsuitable as sites for septic tank absorption fields, dwellings and small commercial buildings, and local roads and streets. Extensive land shaping is needed if roads are built on these soils.

Capability subclass VIIe; woodland suitability subclass 4s.

Uy—Udorthents, loamy. This map unit consists of steep and very steep, well drained soils on escarpments adjacent to lakes, streams, and stream terraces. Individual areas are long and narrow and generally are 5 to 30 acres in size. Slope ranges from 20 to 45 percent.

The color, texture, and thickness of individual layers vary widely. As a result, these soils cannot be classified at the series level. The surface layer is typically sandy loam, loam, or silt. In most areas the soils are dominantly loamy to a depth of about 30 inches.

Included with these soils in mapping are a few areas of the somewhat excessively drained sandy Udorthents and a few areas where bedrock is within 60 inches of the surface. Also included are a few areas where the slope is less than 20 percent. Included areas make up 2 to 10 percent of the unit.

Permeability is dominantly moderate, moderately rapid, or moderately slow, but in places it is rapid or very rapid in the underlying material. Available water capacity is dominantly moderate or high.

Nearly all areas are woodland. The potential is fair for woodland and poor for cultivated crops, pasture, and most engineering uses.

Because of the slope and a very severe erosion hazard, these soils are generally unsuited to cultivated crops. They are poorly suited to growing pasture grasses and legumes. Bluegrass is commonly grown in areas where slopes hinder farm machinery and where renovation by chemicals is not feasible. Overgrazing results in surface compaction, poor tilth, and excessive erosion. Proper stocking rates and pasture rotations keep the pasture and the soil in good condition.

These soils are suited to trees used for wood products. The soil related problems of forest management are the slope and the encroachment of brush following harvest. Planting trees on the contour and carefully locating skid roads during harvest minimize erosion. Care in planting and selection of vigorous planting stock improve seedling survival on slopes facing south or west. Suitable herbicides effectively control the brush competing with natural regeneration following harvest. The brush can be removed mechanically if it is a problem. Skidding can expose sufficient mineral soil to allow adequate regeneration.

Because they are steep and very steep, these soils are generally unsuitable as sites for septic tank absorption fields, dwellings and small commercial buildings, and local roads and streets. Extensive land shaping is needed if roads are built on these soils.

Capability subclass VIIe; woodland suitability subclass 3r.

Wv—Warman Variant sandy loam. This nearly level, poorly drained and very poorly drained soil is in depressional areas on outwash plains and on low stream terraces. In some areas it is subject to occasional flooding. Individual areas are irregularly shaped or long and narrow and generally are 3 to 15 acres in size.

Typically, the surface layer is very dark gray sandy loam about 9 inches thick. It is mottled in the lower part. The subsoil is about 19 inches thick. It is gray, mottled sandy loam over strong brown, mottled gravelly loamy sand. The underlying material to a depth of about 60 inches is brown, stratified coarse sand and gravel. In places the surface layer is loam or silt loam. In some areas the upper part of the subsoil is silt loam. In a few areas the underlying material contains little or no gravel.

Included with this soil in mapping are a few areas of the somewhat poorly drained Cromwell Variant and Poskin soils on convex slopes and small areas of the very poorly drained, organic Markey soils in shallow depressions. Also included are a few areas where, as a result of loamy or silty strata in the underlying material, the downward movement of water is impeded and available water capacity is higher. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the upper loamy material and very rapid in the underlying material. Available water capacity is moderate. Organic-matter content is high. This soil is saturated within a foot of the surface during wet periods unless it is drained. The roots of some plants are restricted by the high water table. Areas on outwash plains receive runoff from adjacent slopes and are likely to be ponded for brief periods after heavy rains.

Many areas remain wooded. Some are farmed or pastured. The potential is poor for cultivated crops, pasture, woodland, and most engineering uses.

Because it has a high water table, this soil is poorly suited to growing corn and small grain and to grasses and legumes for forage. Surface or open ditches and measures that protect the soil against flooding or ponding are needed if cultivated crops are grown. This excessively wet soil warms up slowly in spring. The number of frost-free days per growing season is less on this soil than on adjacent soils because of cold air drainage.

This soil is poorly suited to growing many of the pasture grasses and legumes because of the high water table. Unless the soil is adequately drained, bluegrass is commonly grown. Grazing should be restricted to dry periods. Even under good management, yields are generally low.

This soil is poorly suited to woodland. Trees grow slowly and tend to have poor form. Because the soil is wet, they generally should be planted on prepared ridges if natural regeneration is unreliable. Selection of large, vigorous nursery stock helps to avoid a high mortality rate. Harvest is frequently limited to periods when the ground is frozen. Clear-cut or group-selection harvest methods reduce the danger of windthrow to the remaining trees. Suitable herbicides or mechanical removal controls the competing plants that interfere with natural regeneration.

Because of the high water table and the flooding, this soil is generally unsuited to septic tank absorption fields. Sites for dwellings or small commercial buildings should be artificially drained and protected against flooding or ponding. Sites for local roads and streets should be drained. Providing suitable subbase material helps to prevent the road damage caused by frost action.

Capability subclass IVw; woodland suitability subclass 5w.

Use and management of the soils

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

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

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

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

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

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

Crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

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

About 220,000 acres in Polk County was used for crops and pasture in 1974, according to the 1974 Census of Agriculture for Wisconsin. Of this total, about 38,000 acres was used for permanent pasture; 69,000 acres for row crops, mainly corn; 25,000 acres for small grain, mainly oats; and 86,000 acres for rotation hay and pasture. The rest was idle cropland.

The potential of the soils in Polk County for increased production of food is good. About 120,000 acres of potentially good cropland is woodland and about 35,000 acres pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county.

Soil erosion is the major soil problem on about 70 percent of the cropland and pasture in the county. If the slope is more than 2 percent, erosion is a hazard. Amery and Antigo soils, for example, have slopes of more than 2 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a clayey subsoil, such as Campia Variant soils, and on soils with a layer in or below the subsoil that limits the depth of the root zone. Erosion also reduces productivity on soils that tend to be droughty, such as Burkhardt, Chetek, and Cromwell soils. Second, erosion on farmland results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion-control practices provide protective surface cover, reduce the runoff rate, and increase the infiltration rate. Most slopes in Polk County are so short and irregular that contour tillage or terracing is not practical. In these areas a cropping system that provides substantial plant cover is needed to control erosion unless tillage is kept to a minimum.

A cropping system that keeps a plant cover on the soil for extended periods can hold soil erosion losses to an amount that does not reduce the productive capacity of the soils. Including grasses and legumes in the cropping system not only provides nitrogen for other crops in the rotation but also improves tilth and reduces the risk of erosion.

Keeping tillage to a minimum and leaving crop residue on the surface increase the infiltration rate and reduce the hazards of runoff and erosion. These practices are suitable on most soils in the survey area but are less successful on eroded soils.

Terraces and diversions reduce the length of slopes and the risks of runoff and erosion. Like contour farming and contour stripcropping, they are practical only on soils with smooth, uniform slopes.

Soil blowing is a hazard on the sandy Menahga and Omega soils and on Cathro, Markey, Rifle, and Seelyeville mucks. It can damage these soils in a few hours if winds are strong and the soil is dry and bare of vegetation or surface mulch. Plant cover, surface mulch, and field windbreaks help to control soil blowing.

Information about the erosion-control practices suitable for each kind of soil is contained in the Technical Guide, which is available at local offices of the Soil Conservation Service.

Soil drainage is a major management need on about 9 percent of the acreage used for crops and pasture in the survey area. Some soils are naturally wet or subject to frost. The crops common in the area generally cannot be grown on these soils. These are the poorly drained and very poorly drained soils, such as Adolph, Auburndale, Barronett, Barronett Variant, Bluffton, Newson, and Warman Variant soils. Other wet soils that are seldom cropped are Cathro, Markey, Rifle, and Seelyeville soils, which formed in organic materials.

Unless artificially drained, somewhat poorly drained soils are so wet that crops are damaged during most years. Examples are Alstad, Comstock, Comstock Variant, Cromwell Variant, Dakota Variant, Lino, Magnor, Mora, Plover, and Poskin soils.

The design of both surface and subsurface drainage systems varies with 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 intensively row cropped. Diversions are needed in some areas to divert runoff from adjacent slopes. Adequate outlets are not available in many areas of Adolph and Bluffton soils.

If organic soils are drained and cropped, special management is needed. These soils oxidize and subside when water is removed and air fills the pore space. Special drainage systems are needed to control the depth and the period of drainage. Keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of organic soils.

In most areas of poorly drained and very poorly drained soils, crops are subject to frost damage because these soils are low on the landscape. The number of frost-free days per growing season is lower on these soils than on adjacent upland soils because of cold air drainage.

Information about the drainage system suitable for each kind of soil is contained in the Technical Guide, which is available in local offices of the Soil Conservation Service.

Soil fertility varies in the soils of Polk County, depending in part on the past cropping history. Nearly all of the soils are naturally acid. Unless the soils have been limed, applications of ground limestone are needed to raise the pH level sufficiently for alfalfa and other crops that grow best on nearly neutral soils. In general, less lime is needed on coarse and moderately coarse textured soils than on medium textured soils. Available potash levels are naturally low in many soils in the survey area. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor in the germination of seeds, the emergence of seedlings, and the infiltration of water into the soil. Soils with good tilth are granular and porous. Tilling or grazing when the soil is too wet can result in poor tilth, especially on soils with a loam or silt loam surface layer. Intense rainfall on bare soils can cause surface crusting, which reduces the infiltration rate and increases the risks of runoff and erosion. Maintaining good tilth is more difficult on eroded soils, which have a lower content of organic matter. Returning crop residue to the soil and regularly adding manure or other organic material improve soil structure and tilth.

Field crops suited to the soils and climate of the survey area include many that are not commonly grown. Corn is the most common row crop. Soybeans, sugar beets, and potatoes could be grown. Oats is the most common close-grown crop. Wheat, rye, barley, and buckwheat could be grown, and grass seed could be produced from bromegrass, fescue, and bluegrass.

Special crops grown commercially in the survey area are dominantly sweet corn, peas, and snap beans. Cranberries are grown on a small acreage. Many soils that have good natural drainage and warm up early in spring are suited to a wide variety of vegetables and small fruits. Also, the organic soils, such as Cathro, Markey, Rifle, and Seelyeville soils, could be planted to the vegetable crops that can withstand cool temperatures and a short growing season.

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 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

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

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops (*7*). The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or for engineering purposes.

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

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 5. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

The capability subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

Woodland management and productivity

George W. Alley, forester, Soil Conservation Service, helped prepare this section.

Before settlement, nearly all of Polk County was forested. The extreme northwest corner was a pine barren or savannah of jack pine and grasses, the western part was northern hardwood forest, and the rest was a conifer-hardwood mixture (*4*).

At present, 37 percent, or 220,000 acres, of the land area of Polk County is forested. Most of this forest land occurs as small, privately owned tracts. About 31 percent is aspen-birch, 29 percent oak-hickory, 18 percent conifers, 15 percent maple-beech-birch, 5 percent elm-ash-cottonwood, and 2 percent nonstocked (*10*).

Wood products, especially pulpwood and saw logs, are important to the economy of Polk County. As a result of the maturity of maple and oak stands, an increase in the harvest of saw logs and veneer logs is likely.

Table 6 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 6 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

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

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

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

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

The *potential productivity* of merchantable or *important trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

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

Additional information about woodland management and productivity can be obtained from the Wisconsin Department of Natural Resources and from local offices of the Soil Conservation Service and the Cooperative Extension Service.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 7 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 7 based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service, from nurserymen, or from the Wisconsin Department of Natural Resources.

Engineering

Peg S. Whiteside, soil mechanics engineer, Soil Conservation Service, helped prepare this section.

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

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

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

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

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

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

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities. Table 11 shows the kind of limitations for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

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

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

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 5 feet unless otherwise noted.

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

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Potential frost action is not considered, but proper design of footings and suitable subbase material are needed on most soils in the survey area. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

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

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

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

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

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

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

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

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory. In some areas filtering mounds can be built over wet or impervious soil or soil underlain by bedrock, but the use of these special systems is controlled by local or State ordinances.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

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

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

Unless otherwise stated, the limitations in table 9 apply only to the soil material within a depth of about 5 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

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

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

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

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 5 feet.

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

The ratings apply to the soil material between the A horizon and a depth of 5 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

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

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 5 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

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

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

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

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

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

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

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

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

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 11 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

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

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

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

Recreation

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 12 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have 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 a surface that is free of stones and boulders and have moderate slopes. Suitability of the soil for traps, tees, or greens was not considered in rating the soils. Irrigation is an assumed management practice.

Wildlife habitat

Steve F. Baima, biologist, Soil Conservation Service, helped prepare this section.

Wildlife is affected by soil management. Generally, the population of adapted wildlife is in balance with the available essential habitat elements, including food, cover, and water. Soils directly affect the kind and amount of introduced and native vegetation that is available to wildlife as food and cover. They also affect the construction of ponds and the development of wetland wildlife habitat. Several kinds of soil and a combination of land uses help to provide the essential habitat elements of a selected species of wildlife.

In the following paragraphs the eight map units identified under the heading "General soil map for broad land-use planning" are described in terms of four wildlife areas. The wildlife species in these four areas and the potential for development of wildlife habitat differ. The true value of each of the areas is determined by interspersion with the other areas; the diversity of wildlife is determined by the diversity of soils, land uses, and management in all of the wildlife areas.

Wildlife area 1. This wildlife area is on the Amery-Santiago-Magnor and the Rosholt-Cromwell-Menahga map units. The soils are nearly level to very hilly and are silty, loamy, and sandy. Most of this area is forested, especially in the northern part of the county.

Woodland wildlife habitat is the principal kind of wildlife habitat in the area, but lakes, ponds, and depressional wetlands are common. The wetlands in forested areas are wooded swamps (type 7) or shrub swamps (type 6). In the more intensively cultivated areas, fresh meadows (type 2) and shallow freshwater marshes (type 3) predominate (*5*).

The diverse kinds of habitat in this area support a wide variety of wildlife. The major game species are cottontail rabbit, snowshoe hare, ruffed grouse, gray squirrel, white-tailed deer, and a limited number of bobcat and black bear. Common furbearers are raccoon, muskrat, mink, beaver, otter, and gray and red fox. Mallard, blue-winged teal, and wood duck are the most common waterfowl species.

Wildlife area 2. This wildlife area is on the Omega-Newson-Nymore map unit. The soils are nearly level to hilly and are sandy. Except for small abandoned fields, almost all of this area is forested. Jack pine, pin oak, and brush along drainageways provide cover for many species of wildlife. Cowan Creek, Trade River, and some of the smaller streams are the major sources of water.

The major game and furbearer species in this area are ruffed grouse, raccoon, coyote, fox, white-tailed deer, and a few bobcat and black bear. This area is the least productive wildlife habitat in the county and has the most severe limitations.

Wildlife area 3. This wildlife area is on the Magnor-Freeon, Antigo-Rosholt, Burkhardt-Dakota, and Alban-Campia-Comstock map units. The soils are mainly nearly level to sloping and are loamy and silty. Most of this area is farmed. Corn, small grain, and alfalfa are the main crops. Native grasses and brush along streams and in wet depressions and small scattered woodlots provide most of the habitat cover.

The major game and furbearer species are cottontail rabbit, fox squirrel, raccoon, gray and red fox, badger, and white-tailed deer. The common waterfowl species are mallards and blue-winged teal. Proper management of woodlands and wetlands can improve the population of these species and that of the numerous nongame species in the area.

Wildlife area 4. This wildlife area is on the Cushing-Rifle map unit. The soils are undulating to very hilly loamy soils or nearly level organic soils. Most of the upland areas are farmed, but the hilly and very hilly areas are pasture or woodland. The lowland areas are wooded or support native grasses. They provide good cover for wildlife. Wetland types are fresh meadows (type 2), shalow fresh marshes (type 3), deep fresh marshes (type 4), open fresh water (type 5), and shrub swamps (type 6).

The major game and furbearer species in this area are cottontail rabbit, squirrel, ruffed grouse, raccoon, muskrat, mink, fox, and white-tailed deer. The wetlands support a significant breeding population of mallards and blue-winged teal.

In table 13, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established dryland grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

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

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

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

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

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

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

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

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

Soil properties

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

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

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

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

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 17. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

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

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

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

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

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

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

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

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

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

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

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

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

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

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

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

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 16 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. Only saturated zones above a depth of 6 feet are indicated.

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

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Subsidence is the settlement of organic soils or of soils containing semifluid layers. Initial subsidence generally results from drainage. Total subsidence is initial subsidence plus the slow sinking that occurs over a period of several years as a result of the oxidation or compression of organic material.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving (fig. 12) and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 17.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Wisconsin Department of Transportation, Division of Highways.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The code for the Unified classification is assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-69); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); and moisture-density, method A (T99-57).

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*6*). Unless otherwise noted, colors described are for moist soil.

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

Adolph series

The Adolph series consists of deep, very poorly drained, moderately slowly permeable soils in depressional areas on glacial moraines. These soils formed in silty sediments and in the underlying sandy loam glacial till. Slope ranges from 0 to 2 percent.

Adolph soils are similar to Auburndale and Bluffton soils and are commonly adjacent to Amery, Freeon, and Magnor soils on the landscape. Amery soils are well drained and typically are steeper than Adolph soils. Auburndale soils have a thinner or lighter colored surface layer than Adolph soils and contain more silt in the lower part of the solum. Bluffton soils contain more clay in the control section than Adolph soils and are underlain by calcareous loam glacial till. The moderately well drained Freeon and somewhat poorly drained Magnor soils have an argillic horizon and are higher on the landscape than Adolph soils.

Typical pedon of Adolph silt loam, 210 feet west and 1,600 feet north of the southeast corner of sec. 20, T. 36 N., R. 19 W.

A11—0 to 8 inches; black (10YR 2/1) silt loam; moderate fine granular structure; friable; many roots; estimated 1 percent gravel; slightly acid; clear wavy boundary.

A12—8 to 10 inches; very dark gray (10YR 3/1) silt loam; few medium faint dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure; friable; many roots; estimated 1 percent gravel; slightly acid; clear wavy boundary.

B1g—10 to 15 inches; dark gray (10YR 4/1) silt loam; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very friable; few roots; medium acid; clear wavy boundary.

B2g—15 to 25 inches; gray (10YR 5/1) silt loam; common fine prominent reddish brown (5YR 4/4) and few fine faint gray (10YR 6/1) mottles; weak fine and very fine subangular blocky structure; very friable; few roots; estimated 2 percent gravel; strongly acid; clear wavy boundary.

IIB3g—25 to 31 inches; pinkish gray (7.5YR 6/2) sandy loam; common medium prominent yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; very friable; few roots; estimated 5 percent gravel; slightly acid; clear wavy boundary.

IIC—31 to 60 inches; brown (7.5YR 5/4) sandy loam; few medium distinct light brownish gray (10YR 6/2) and many medium prominent reddish yellow (7.5YR 6/8) mottles; massive; estimated 8 percent gravel; neutral.

The solum ranges from 30 to 45 inches in thickness. The mollic epipedon ranges from 10 to 18 inches in thickness. The depth to glacial till ranges from 18 to 30 inches. The content of coarse fragments is, by volume, 0 to 5 percent in the A and B horizons and 5 to 15 percent in the IIB and IIC horizons. The part of the solum that is not influenced by agricultural lime ranges from strongly acid to neutral.

The A1 horizon has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an Ap horizon. The Bg horizon has color value of 4 or 5 and chroma of 1. It is typically silt loam but is very fine sandy loam or loam in some pedons. The IIB horizon has color value of 4 to 6 and chroma of 1 or 2. The IIB and IIC horizons are typically sandy loam but are fine sandy loam or gravelly sandy loam in some pedons. The IIC horizon is typically slightly acid or neutral but is mildly alkaline in some pedons.

Alban series

The Alban series consists of deep, well drained, moderately permeable soils on glacial lake plains and terraces. These soils formed in stratified loamy lacustrine sediments. Slope ranges from 0 to 20 percent.

Alban soils are similar to Campia soils and are commonly adjacent to Campia, Crystal Lake, and Plover soils on the landscape. The well drained Campia and moderately well drained Crystal Lake soils contain more silt and clay in the control section than Alban soils. They are intermingled with those soils. The somewhat poorly drained Plover soils are lower on the landscape than Alban soils and are less sloping.

Typical pedon of Alban fine sandy loam, 0 to 2 percent slopes, 1,220 feet west and 1,260 feet north of the southeast corner of sec. 35, T. 34 N., R. 15 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak medium subangular blocky structure parting to moderate medium granular; very friable; many roots; slightly acid; abrupt smooth boundary.

A2—8 to 20 inches; brown (10YR 5/3) sandy loam; weak thick platy structure; very friable; many roots; slightly acid; clear wavy boundary.

A&B—20 to 32 inches; grayish brown (10YR 5/2) loamy fine sand (A2); weak thick platy structure; friable; about 60 percent of the horizon occurs as tongues, 20 to 40 millimeters thick, extending into or completely surrounding isolated remnants of dark brown (7.5YR 4/4) very fine sandy loam (B2t); weak medium subangular blocky structure; friable; few thin patchy clay films on faces of some peds (B2t); strong brown (7.5YR 5/6) iron stains along edges of A2 tongues; many roots; slightly acid; gradual irregular boundary.

B&A—32 to 44 inches; dark brown (7.5YR 4/4) very fine sandy loam (B2t); weak medium subangular blocky structure; friable; the B2t part makes up about 80 percent of the horizon; few thin patchy clay films on faces of peds (B2t); tongues, 10 to 30 millimeters thick, of grayish brown (10YR 5/2) fine sandy loam (A2) extend to bottom of horizon; weak thick platy structure; friable; many roots; slightly acid; clear wavy boundary.

B3—44 to 47 inches; dark brown (7.5YR 4/4) fine sandy loam; weak thick platy structure parting to weak fine subangular blocky; very friable; few roots; slightly acid; clear wavy boundary.

C1—47 to 56 inches; brown (7.5YR 5/4) fine sandy loam; weak thick platy structure; very friable; few roots; slightly acid; clear wavy boundary.

C2—56 to 60 inches; strong brown (7.5YR 5/6) fine sand and sand; single grained; loose; few dark brown (7.5YR 4/4) loamy fine sand bands 1 centimeter to 3 centimeters thick; few roots; medium acid.

The solum ranges from 25 to 55 inches in thickness and from strongly acid to neutral.

The Ap horizon is 6 to 10 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon. This horizon is 1 inch to 4 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. The A2 horizon and the A2 part of the A&B and B&A horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. They are typically loamy sand, loamy fine sand, sandy loam, or fine sandy loam but are loam or silt loam in some pedons.

The Bt part of the A&B and B&A horizons and the B2t horizon, if it occurs, have hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 3 to 6. They are dominantly sandy loam or fine sandy loam but in some pedons have thin layers of loamy sand, loam, very fine sandy loam, or silt loam.

The C horizon has hue of 10YR, 7.5YR, or 5YR and value and chroma of 4 to 6. It is typically fine sandy loam stratified with fine sand and sand, but in some pedons it is stratified silt, very fine sand, and fine sand. It is medium acid to neutral.

Alstad series

The Alstad series consists of deep, somewhat poorly drained, moderately slowly permeable soils in plane or concave areas on glacial uplands. These soils formed in loamy glacial till. Slope ranges from 0 to 3 percent.

Alstad soils are similar to Magnor soils and are commonly adjacent to Bluffton and Cushing soils on the landscape. Magnor soils are more acid than Alstad soils and are underlain with redder sandy loam glacial till. The well drained and moderately well drained Cushing soils are higher on the landscape than Alstad soils and are more sloping. The poorly drained and very poorly drained Bluffton soils are in the lower depressional areas.

Typical pedon of Alstad loam, 0 to 3 percent slopes, 120 feet east and 240 feet south of the northwest corner of sec. 25, T. 36 N., R. 19 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure parting to moderate medium granular; friable; many roots; neutral; abrupt wavy boundary.

A2—11 to 16 inches; brown (10YR 5/3) loam; many medium faint grayish brown (10YR 5/2) and prominent yellowish brown (10YR 5/6) mottles; moderate medium and thick platy structure; friable; many roots; neutral; gradual wavy boundary.

A&B—16 to 20 inches; brown (7.5YR 5/2) loam (A2); weak thick platy structure; friable; about 60 percent of the horizon occurs as tongues extending into or completely surrounding isolated remnants of dark brown (7.5YR 4/4) loam (B2t); moderate medium subangular blocky structure; firm; few thin patchy clay films on faces of peds (B2t); estimated less than 5 percent gravel and less than 1 percent cobbles; many roots; neutral; gradual wavy boundary.

B&A—20 to 38 inches; dark brown (7.5YR 4/4) clay loam (B2t); many medium distinct strong brown (7.5YR 5/6), yellowish red (5YR 5/6), and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; few manganese spots and streaks; tongues, as much as 40 millimeters thick, of brown (7.5YR 5/2) loam (A2) extend to bottom of horizon; weak thick platy structure; friable; estimated less than 5 percent gravel and less than 1 percent cobbles; many roots; slightly acid; clear wavy boundary.

B2t—38 to 45 inches; dark brown (7.5YR 4/4) clay loam; many medium distinct grayish brown (10YR 5/2), reddish brown (5YR 4/4), and yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; few spots and streaks of manganese; estimated less than 5 percent gravel; many roots; slightly acid; gradual wavy boundary.

B3—45 to 51 inches; dark brown (7.5YR 4/4) loam; many coarse distinct yellowish red (5YR 5/6) and grayish brown (10YR 5/2) mottles; few thin patchy clay films on vertical faces of peds and along structural cracks; many fine manganese spots and streaks; estimated less than 5 percent gravel; few roots; medium acid; gradual wavy boundary.

C—5l to 60 inches; brown (7.5YR 5/4) loam; many medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; estimated less than 5 percent gravel; mildly alkaline.

The solum ranges from 25 to 55 inches in thickness. The content of coarse fragments ranges from 5 to 15 percent in the B and C horizons. The content of cobbles ranges from 0 to 5 percent in the lower part of the solum and in the C horizon. The part of the solum that is not influenced by agricultural lime typically is medium acid to neutral, but in some pedons it is strongly acid or mildly alkaline.

The Ap horizon is 7 to 12 inches thick. It has color value of 2 or 3 and chroma of 1 to 3. Some pedons have an A1 horizon. The A2 horizon and the A2 part of the A&B and B&A horizons have color value of 4 or 5 and chroma of 2 or 3. The B2t horizon and the Bt part of the A&B and B&A horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. They are loam, sandy clay loam, or clay loam. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It ranges from neutral to moderately alkaline. It is typically loam but is sandy clay loam or clay loam in a few pedons.

Amery series

The Amery series consists of deep, well drained, moderately permeable or moderately slowly permeable soils on glacial uplands. These loamy soils are underlain by sandy loam or loamy sand glacial till. Slope ranges from 1 to 45 percent.

Amery soils are similar to Santiago soils and are commonly adjacent to Cromwell, Freeon, Magnor, Mora, and Santiago soils on the landscape. Cromwell soils lack an argillic horizon and are underlain by sand. The moderately well drained Freeon and somewhat poorly drained Magnor and Mora soils are slightly lower on the landscape than Amery soils. Santiago soils contain more silt and clay in the solum than Amery soils.

Typical pedon of Amery sandy loam, 12 to 20 percent slopes, 150 feet north and 1,700 feet east of the southwest corner of sec. 26, T. 34 N., R. 15 W.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) dry; moderate and weak fine subangular blocky structure; friable; very strongly acid; abrupt smooth boundary.

A21—3 to 9 inches; dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) sandy loam; weak very fine and fine subangular blocky structure; friable; strongly acid; clear wavy boundary.

A22—9 to 19 inches; brown (7.5YR 5/4) sandy loam; weak thin platy structure; very friable; 6 to 8 percent pebbles and cobblestones; numerous inped and exped vesicles; medium acid; clear wavy boundary.

A&B—19 to 26 inches; brown (7.5YR 4/4) sandy loam (A2); weak thin platy structure; friable; about 75 percent of the horizon occurs as tongues extending into or completely surrounding isolated remnants of reddish brown (5YR 4/4) and yellowish red (5YR 4/6) sandy loam (B2t); weak medium subangular blocky structure; friable; peds have slightly brittle characteristics; thin patchy clay films on faces of subangular blocky peds; 8 to 10 percent pebbles and cobblestones by volume; medium acid; gradual wavy boundary.

B&A—26 to 35 inches; reddish brown (5YR 4/4) and yellowish red (5YR 4/6) sandy loam (Bt); the Bt part makes up about 70 percent of the horizon; weak and moderate fine and medium subangular blocky structure; tongues and interfingers of brown (7.5YR 4/4) loamy sand and sandy loam (A2) penetrating from the A&B horizon; friable; peds have slightly brittle characteristics; thin patchy clay films on faces of peds, more numerous than in the A&B horizon; 8 to 10 percent pebbles and cobblestones by volume; medium acid; gradual wavy boundary.

B3—35 to 44 inches; reddish brown (5YR 4/4) and yellowish red (5YR 4/8) loamy sand; weak and moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; 8 to 10 percent pebbles and cobblestones by volume; medium acid; gradual wavy boundary.

C1—44 to 54 inches; reddish brown (5YR 4/4) and yellowish red (5YR 4/6) loamy sand; weak medium and coarse subangular blocky structure and weak coarse petrogenic platiness throughout; friable; some clay bridging of sand grains; a few A2 tongues, 30 to 100 centimeters apart, penetrate this horizon; 10 to 12 percent pebbles and cobblestones by volume; slightly acid; gradual wavy boundary.

C2—54 to 60 inches; reddish brown (5YR 4/4) and yellowish red (5YR 4/6) loamy sand; weak thick platy structure; friable; some clay bridging of sand grains; 10 to 12 percent pebbles and cobblestones by volume; slightly acid.

The solum ranges from 30 to 50 inches in thickness. The content of coarse fragments ranges from 0 to 10 percent in the upper part of the solum and from 8 to 15 percent in the lower part and in the C horizon. The part of the solum that is not influenced by agricultural lime is typically medium acid or slightly acid, but in some pedons the A horizon is strongly acid or very strongly acid. Bulk density in the lower part in the B horizon and in the C horizon is more than 1.7 grams per cubic centimeter.

The A1 horizon is 1 inch to 4 inches thick. It has color value of 2 to 4 and chroma of 1 to 3. It is sandy loam or silt loam. Some pedons have an Ap horizon, which is 7 to 10 inches thick. The A2 horizon and the A2 part of the A&B and B&A horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. They are sandy loam, loam, silt loam, or loamy sand. In some pedons the upper part of the A2 horizon has colors of high chroma similar to those of spodic horizons, but such layers are too thin or too weakly expressed to qualify as spodic horizons.

Some pedons have a B2t horizon. The Bt part of the A&B and B&A horizons and the B2t horizon have hue of 7.5YR, 5YR, or 2.5YR; value of 3 to 5; and chroma of 3 to 6. They are typically loam or sandy loam but are fine sandy loam in some pedons.

The C horizon has hue of 7.5YR, 5YR, or 2.5YR and value and chroma of 3 to 6. It is typically sandy loam or loamy sand but is fine sandy loam in some pedons. It is medium acid or slightly acid.

Antigo series

The Antigo series consists of deep, well drained soils that are moderately permeable in the upper part and very rapidly permeable in the underlying material. These soils are on glacial outwash plains and stream terraces. They formed in silty sediments and in the underlying sand and gravel glacial outwash. Slope ranges from 0 to 20 percent.

Antigo soils are similar to Dakota and Rosholt soils and are commonly adjacent to Brill, Poskin, Rosholt, and Santiago soils on the landscape. Dakota soils have a mollic epipedon and contain more sand and less silt in the upper part of the solum than Antigo soils. Rosholt soils contain more sand and less silt in the upper part than Antigo soils. The moderately well drained Brill and somewhat poorly drained Poskin soils are slightly lower on the landscape than Antigo soils. Santiago soils are underlain with sandy loam glacial till.

Typical pedon of Antigo silt loam, 0 to 2 percent slopes, 150 feet west and 800 feet north of the southeast corner of sec. 25, T. 34 N., R. 17 W.

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

A2—10 to 14 inches; brown (10YR 5/3) silt loam; moderate thin platy structure; friable; many roots; slightly acid; clear wavy boundary.

B&A—14 to 20 inches; dark yellowish brown (10YR 4/4) silt loam (B2t); moderate fine subangular blocky structure; friable; few thin patchy clay films on faces of some peds; tongues of brown (10YR 5/3) silt loam (A2), 10 to 20 millimeters thick, extend to bottom of horizon and make up about 30 percent of the horizon; moderate thin platy structure; many roots; medium acid; clear wavy boundary.

B2t—20 to 30 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of most peds; many roots; medium acid; clear wavy boundary.

IIB3—30 to 34 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable; few thin patchy clay films on faces of peds; estimated 6 percent cobbles and 10 percent gravel; many roots; medium acid; abrupt wavy boundary.

IIC1—34 to 47 inches; dark brown (7.5YR 4/4) and reddish brown (5YR 4/4) coarse sand; single grained; loose; estimated 10 percent gravel; few roots; medium acid; abrupt wavy boundary.

IIC2—47 to 60 inches; dark brown (7.5YR 4/4) stratified sand and gravel; single grained; loose; estimated 40 percent gravel; few roots; medium acid.

The solum ranges from 24 to 40 inches in thickness and the depth to outwash sand and gravel from 20 to 36 inches. The content of coarse fragments ranges from 0 to 20 percent in the IIB horizon and from 15 to 45 percent in the IIC horizon. The content of cobbles ranges from 0 to 6 percent in the IIB and IIC horizons. The part of the solum that is not influenced by agricultural lime ranges from very strongly acid to slightly acid.

The Ap horizon is 6 to 10 inches thick. It has color value of 3 to 5 and chroma of 2 or 3. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick and has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an A&B horizon. The A2 horizon and the A2 part of the B&A and A&B horizons have color value of 4 to 6 and chroma of 2 or 3. They are silt loam or silt.

The B2t horizon and the Bt part of the B&A and A&B horizons have hue of 10YR or 7.5YR and value and chroma of 4 or 5. They are silt loam or silty clay loam. The IIB3 horizon has hue of 10YR, 7.5YR, or 5YR and value and chroma of 4 to 6. It is loam, sandy loam, or gravelly sandy loam.

The IIC horizon is stratified sand and gravel or gravelly coarse sand. It is dominantly medium acid to neutral but is strongly acid in a few pedons.

Auburndale series

The Auburndale series consists of deep, poorly drained, moderately slowly permeable soils in broad, slightly concave areas and in drainageways on glacial ground moraines. These soils formed in silty sediments. Slope ranges from 0 to 3 percent.

Auburndale soils are similar to Adolph and Barronett soils and are commonly adjacent to Adolph, Freeon, and Magnor soils on the landscape. Adolph soils are very poorly drained and lack an argillic horizon. They are in depressional areas. Barronett soils formed in silty lacustrine sediments. The moderately well drained Freeon and somewhat poorly drained Magnor soils are slightly higher on the landscape than Auburndale soils and are more sloping.

Typical pedon of Auburndale silt loam, 0 to 3 percent slopes, 234 feet west and 1,540 feet north of the southeast corner of sec. 28, T. 32 N., R. 16 W.

A1—0 to 4 inches; black (10YR 2/1) silt loam; moderate medium and fine granular structure; friable; many roots; slightly acid; clear wavy boundary.

A2—4 to 13 inches; light brownish gray (10YR 6/2) silt; common medium and fine prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/8) mottles; moderate very thin platy structure; very friable; common roots; strongly acid; clear wavy boundary.

B&A—13 to 18 inches; grayish brown (2.5Y 5/2) silt loam (Bt); common fine prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; friable; thin patchy brown (10YR 5/3) clay films on faces of some peds; tongues of light brownish gray (10YR 6/2) silt (A2) make up about 25 percent of the horizon; moderate fine platy structure; very friable; few roots; very strongly acid; clear wavy boundary.

B2tg—18 to 26 inches; grayish brown (2.5Y 5/2) silt loam; common medium and fine prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; friable; thin patchy brown (10YR 5/3) clay films on faces of some peds; few roots; very strongly acid; clear wavy boundary.

B3g—26 to 31 inches; light brownish gray (2.5Y 6/2) silt loam; common medium prominent reddish yellow (7.5YR 6/8) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; very strongly acid; clear wavy boundary.

C—31 to 60 inches; light gray (2.5Y 7/2) silt; common medium and fine prominent reddish yellow (7.5YR 6/8) and yellowish brown (10YR 5/6) mottles; massive; friable; medium acid.

The solum ranges from 30 to 40 inches in thickness. The silty mantle is 35 to 60 inches deep over loam glacial till. The part of the solum that is not influenced by agricultural lime ranges from very strongly acid to medium acid.

The A1 horizon is 1 inch to 4 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an Ap horizon, which is 6 to 10 inches thick. This horizon has color value of 3 to 5 and chroma of 1 or 2. Some pedons have an A&B horizon. The A2 horizon and the A2 part of the B&A and A&B horizons have hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. They are silt or silt loam. The B2 horizon and the Bt part of the B&A and A&B horizons have hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

The C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. It is silt, silt loam, or loam and is slightly acid or medium acid. Some pedons have IIB3 and IIC horizons, which formed in glacial till.

Barronett series

The Barronett series consists of deep, poorly drained, moderately slowly permeable soils on glacial lake plains and terraces. These soils formed in silty material and in the underlying silty and sandy lacustrine sediments. Slope ranges from 0 to 2 percent.

Barronett soils are similar to Barronett Variant soils and are commonly adjacent to Barronett Variant and Comstock soils on the landscape. Barronett Variant soils contain more sand and less silt in the control section. The somewhat poorly drained Comstock soils are higher on the landscape than Barronett soils.

Typical pedon of Barronett silt loam, 2,060 feet east and 1,460 feet north of the southwest corner of sec. 22, T. 35 N., R. 15 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam; weak fine subangular blocky structure; friable; common roots; neutral; abrupt smooth boundary.

A2—9 to 16 inches; light gray (10YR 6/1) silt loam; few fine prominent reddish yellow (7.5YR 6/8) mottles; weak thick platy structure parting to weak fine subangular blocky; friable; few roots; few earthworm casts; medium acid; clear wavy boundary.

B21tg—16 to 23 inches; light gray (10YR 6/1) silt loam; common fine prominent reddish yellow (7.5YR 6/8) and few fine prominent red (2.5YR 4/6) mottles; weak fine subangular blocky structure; friable; few roots; clay films in many pores; medium acid; clear wavy boundary.

B22tg—23 to 34 inches; light gray (10YR 6/1) silt loam; few fine prominent yellowish red (5YR 5/6) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few roots; clay films in some pores; medium acid; clear wavy boundary.

C—34 to 60 inches; light brownish gray (10YR 6/2) stratified silt and very fine sand; few fine prominent yellowish red (5YR 4/6) and yellowish brown (10YR 5/6) mottles; weak thick platy structure; very friable; slightly acid.

The solum ranges from 30 to 44 inches in thickness. Below the part that is influenced by agricultural lime, it ranges from strongly acid to neutral.

The Ap horizon is 6 to 9 inches thick. It has hue of 10YR or 2.5YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an A1 horizon, which is 1 inch to 5 inches thick. The A2 horizon has hue of 10YR or 2.5YR, value of 4 to 6, and chroma of 1 or 2. It is silt loam, loam, or very fine sandy loam.

The Bt horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is silt loam, loam, or silty clay loam.

The C horizon is typically stratified silt and very fine sand, but in some pedons it has thin layers of silty clay loam, silt loam, fine sandy loam, or fine sand. It ranges from medium acid to mildly alkaline.

Barronett Variant

The Barronett Variant consists of deep, poorly drained, moderately permeable soils on glacial lake plains and terraces. These soils formed in stratified loamy, sandy, and silty lacustrine sediments. Slope ranges from 0 to 2 percent.

Barronett Variant soils are similar to other Barronett soils and are commonly adjacent to those soils and to Plover soils on the landscape. The other Barronett soils contain more silt and less sand in the control section. The somewhat poorly drained Plover soils are slightly higher on the landscape than the Barronett Variant.

Typical pedon of Barronett Variant fine sandy loam, 144 feet north and 1,695 feet east of the southwest corner of sec. 36, T. 36 N., R. 19 W.

Ap—0 to 12 inches; black (10YR 2/1) fine sandy loam; few fine prominent light gray (5Y 6/1) mottles; weak fine subangular blocky structure; very friable; common roots; slightly acid; abrupt smooth boundary.

B1g—12 to 19 inches; light gray (5Y 6/1) loamy fine sand; few medium prominent strong brown (7.5YR 5/6) mottles; weak medium platy structure parting to weak very fine subangular blocky; very friable; few roots; slightly acid; clear wavy boundary.

B2g—19 to 25 inches; gray (5Y 5/1) silt loam; common medium prominent dark reddish brown (2.5YR 3/4) and few fine prominent yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure parting to weak thin platy; friable; few roots; medium acid; clear wavy boundary.

B3g—25 to 31 inches; light gray (5Y 6/1) coarse silt; many coarse prominent strong brown (7.5YR 5/8) and common fine prominent dark reddish brown (2.5YR 3/4) mottles along root channels; weak medium prismatic structure parting to weak medium subangular blocky; very friable; few roots; very strongly acid; clear wavy boundary.

C1—31 to 38 inches; light gray (5Y 6/1) and strong brown (7.5YR 5/6) fine sand; few medium distinct dark reddish brown (2.5YR 3/4) mottles; massive; very strongly acid; clear wavy boundary.

C2—38 to 60 inches; light gray (5Y 6/1) and light reddish brown (5YR 6/3) stratified silt, silty clay, and fine sand; common fine prominent strong brown (7.5YR 5/6) mottles; massive; slightly acid.

The solum ranges from 20 to 40 inches in thickness. The C horizon and the part of the solum that is not influenced by agricultural lime range from very strongly acid to slightly acid.

The Ap horizon is 8 to 12 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an A1 horizon, which is 7 to 12 inches thick. The B horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is typically loamy fine sand, fine sandy loam, silt, or silt loam, but some subhorizons are sandy loam or loamy sand. The C horizon is typically stratified silt, silty clay, and fine sand, but in some pedons it has thin layers of very fine sand, silt loam, or fine sandy loam.

Bluffton series

The Bluffton series consists of deep, poorly drained and very poorly drained, moderately slowly permeable soils in depressional areas on glacial moraines. These soils formed in loamy glacial till. Slope ranges from 0 to 2 percent.

Bluffton soils are similar to Adolph soils and are commonly adjacent to Alstad, Cushing, and Rifle soils on the landscape. Adolph soils contain less clay in the control section than Bluffton soils and are underlain by sandy loam glacial till. The somewhat poorly drained Alstad soils and the well drained and moderately well drained Cushing soils are slightly higher on the landscape than Bluffton soils. The very poorly drained Rifle soils formed in organic material. They are in the lower depressions.

Typical pedon of Bluffton loam, 85 feet north and 1,420 feet west of the southeast corner of sec. 23, T. 36 N., R. 19 W.

Ap1—0 to 6 inches; very dark grayish brown (10YR 3/2) loam; weak medium granular structure; friable; estimated 2 percent gravel; many roots; slightly acid; abrupt wavy boundary.

Ap2—6 to 10 inches; very dark gray (5Y 3/1) loam; common fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; estimated 3 percent gravel; common roots; medium acid; abrupt wavy boundary.

B1g—10 to 12 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent strong brown (7.5YR 5/6), red (2.5YR 4/8), and pale olive (5Y 6/4) mottles; weak medium subangular blocky structure; friable; estimated 3 percent gravel and 1 percent cobbles; few roots; medium acid; clear wavy boundary.

B21g—12 to 20 inches; gray (5Y 5/1) loam; many fine prominent strong brown (7.5YR 5/6), pale olive (5Y 6/4), and red (2.5YR 4/8) mottles; weak coarse subangular blocky structure; friable; estimated 4 percent gravel and 1 percent cobbles; few roots; medium acid; clear wavy boundary.

B22g—20 to 26 inches; gray (5Y 6/1) loam; common fine prominent strong brown (7.5YR 5/6), pale olive (5Y 6/4), and red (2.5YR 4/8) mottles; weak coarse subangular blocky structure; friable; estimated 1 percent gravel and 2 percent cobbles; few roots; medium acid; clear wavy boundary.

Cg—26 to 60 inches; gray (5Y 6/1) loam; common fine prominent pale olive (5Y 6/4) and yellowish red (5YR 5/6) mottles; massive; friable; estimated 7 percent gravel and 3 percent cobbles; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness and the mollic epipedon from 8 to 16 inches. The content of coarse fragments is, by volume, 2 to 10 percent in the solum and the C horizon. The part of the solum that is not influenced by agricultural lime ranges from medium acid to neutral.

The A horizon has hue of 10YR, 5Y, or 2.5YR; value of 2 or 3; and chroma of 1 or 2. The B2g horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is loam, fine sandy loam, or sandy clay loam. The Cg horizon has hue of 5Y or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is mildly alkaline or moderately alkaline. It is typically loam but is fine sandy loam or sandy clay loam in some pedons.

Brill series

The Brill series consists of deep, moderately well drained soils that are moderately permeable in the upper part and very rapidly permeable in the lower part. These soils are on outwash plains and stream terraces. They formed in silty material and in the underlying glacial outwash. Slope ranges from 0 to 3 percent.

Brill soils are similar to Dakota and Dakota Variant soils and are commonly adjacent to Antigo, Poskin, and Rosholt soils on the landscape. The well drained Dakota soils and the somewhat poorly drained Dakota Variant soils have a mollic epipedon. The well drained Antigo and Rosholt soils are slightly higher on the landscape than Brill soils. The somewhat poorly drained Poskin soils are in shallow depressions.

Typical pedon of Brill silt loam, 0 to 3 percent slopes, 2,580 feet south and 880 feet west of the northeast corner of sec. 12, T. 34 N., R. 18 W.

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

A2—7 to 14 inches; brown (10YR 5/3) silt loam; moderate thin platy structure parting to moderate very fine subangular blocky; very friable; common roots; slightly acid; clear wavy boundary.

B&A—14 to 24 inches; dark brown (7.5YR 4/4) silt loam (Bt); moderate medium and fine subangular blocky structure; friable; thin patchy clay films on faces of some peds; tongues of brown (10YR 5/3) silt loam (A2) make up about 35 percent of the horizon; few roots; medium acid; clear wavy boundary.

B2t—24 to 32 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct strong brown (7.5YR 5/6) mottles in the lower part; moderate medium subangular blocky structure; friable; brown (10YR 5/3) coatings along some primary vertical cleavage planes; thin patchy clay films on faces of most peds; few roots; strongly acid; clear wavy boundary.

B31—32 to 36 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; brown (10YR 5/3) interfingering of uncoated silt along some primary vertical cleavage planes; estimated 2 percent gravel; few roots; strongly acid; abrupt wavy boundary.

IIB32—36 to 39 inches; strong brown (7.5YR 5/6) sandy loam; weak coarse subangular blocky structure; very friable; estimated 12 percent gravel; few roots; strongly acid; clear wavy boundary.

IIC—39 to 60 inches; reddish yellow (7.5YR 6/6) stratified sand and gravel; single grained; loose; slightly acid.

The solum ranges from 24 to 40 inches in thickness. Below the part that is influenced by agricultural lime, it ranges from very strongly acid to slightly acid. The depth to glacial outwash ranges from 20 to 36 inches. The content of coarse fragments is, by volume, 2 to 20 percent in the IIB3 horizon and 10 to 40 percent in the IIC horizon.

The Ap horizon is 6 to 10 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon. Some have an A&B horizon. The A2 horizon and the A2 part of the B&A and A&B horizons have color value of 4 to 6 and chroma of 2 or 3. They are silt loam or silt. Some pedons have a weakly expressed Bir horizon above the A2 horizon. The Bt horizon and the Bt part of the B&A and A&B horizons have hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 or 5. They are silt loam or silty clay loam. The IIC horizon is stratified sand and gravel or gravelly coarse sand. It ranges from strongly acid to neutral.

Burkhardt series

The Burkhardt series consists of deep, somewhat excessively drained soils that are moderately rapidly permeable in the upper part and rapidly permeable in the lower part. These soils are on outwash plains and stream terraces. They are underlain by sand and gravel glacial outwash. Slope ranges from 0 to 12 percent. In this survey area the mean annual temperature of Burkhardt soils is a few degrees lower than is defined as the range for the Burkhardt series. This difference, however, does not alter the use or behavior of the soils.

Burkhardt soils are similar to Chetek and Cromwell soils and are commonly adjacent to Dakota, Dakota Variant, and Hubbard soils. Chetek and Cromwell soils lack a mollic epipedon. The well drained Dakota and somewhat poorly drained Dakota Variant soils have an argillic horizon and have a thicker solum than Burkhardt soils. Hubbard soils are sandy throughout and contain less gravel than Burkhardt soils.

Typical pedon of Burkhardt sandy loam, 0 to 2 percent slopes, 1,550 feet north and 1,270 feet east of the southwest corner of sec. 13, T. 33 N., R. 19 W.

Ap—0 to 11 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; very friable; few roots; slightly acid; abrupt smooth boundary.

B2t—11 to 19 inches; dark brown (7.5YR 3/2) sandy loam; weak medium subangular blocky structure; very friable; few roots; clay bridging between sand grains; estimated 2 to 5 percent gravel; few very dark brown (10YR 2/2) earthworm casts; slightly acid; clear wavy boundary.

IIB3—19 to 24 inches; brown (7.5YR 4/4) loamy coarse sand; single grained; loose; estimated 8 to 10 percent gravel; slightly acid; gradual wavy boundary.

IIC—24 to 60 inches; yellowish brown (10YR 5/4) stratified coarse sand and gravel; single grained; slightly acid.

The solum ranges from 18 to 24 inches in thickness. Below the part that is influenced by agricultural lime, it ranges from strongly acid to slightly acid. The mollic epipedon is 8 to 13 inches thick. The content of coarse fragments ranges from 0 to 15 percent in the B horizon and from 15 to 40 percent in the IIC horizon.

The Ap horizon is 7 to 12 inches thick. It has color value of 2 or 3 and chroma of 1 to 3. Some pedons have an A12 horizon. The B2t horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 2 to 4. It is sandy loam or loam. The IIC horizon is gravelly sand or stratified coarse sand and gravel. It is medium acid or slightly acid.

Campia series

The Campia series consists of deep, well drained, moderately permeable soils on glacial lake plains and terraces. These soils formed in silty eolian or lacustrine sediments. Slope ranges from 0 to 12 percent.

Campia soils are similar to Alban and Crystal Lake soils and are commonly adjacent to Alban, Comstock, and Crystal Lake soils on the landscape. Alban soils contain more sand and less silt and clay in the control section than Campia soils. The somewhat poorly drained Comstock soils are lower on the landscape than Campia soils and are less sloping. Crystal Lake soils are moderately well drained.

Typical pedon of Campia silt loam, 0 to 2 percent slopes, 320 feet west and 120 feet south of the center of sec. 36, T. 34 N., R. 15 W.

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

A2—8 to 11 inches; brown (10YR 5/3) silt loam; moderate medium platy structure; friable; many roots; neutral; gradual irregular boundary.

A&B—11 to 14 inches; grayish brown (10YR 5/2) silt (A2); moderate medium platy structure; friable; about 55 percent of horizon occurs as tongues, 20 to 40 millimeters thick, extending into or completely surrounding isolated remnants of dark yellowish brown (10YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; friable; few thin patchy clay films on faces of some peds; many roots; slightly acid; gradual wavy boundary.

B&A—14 to 24 inches; dark brown (7.5YR 4/4) silt loam (Bt); moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; about 30 percent of the horizon occurs as tongues of grayish brown (10YR 5/2) silt loam (A2); weak thick platy structure; friable; many roots; medium acid; gradual wavy boundary.

B2t—24 to 32 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; thick coatings of grayish brown (10YR 5/2) silt loam extend to bottom of horizon; many roots; medium acid; gradual wavy boundary.

B3—32 to 39 inches; dark brown (7.5YR 4/4) silt loam; weak coarse subangular blocky structure; friable; many roots; medium acid; gradual wavy boundary.

C1—39 to 47 inches; dark yellowish brown (10YR 4/4) silt; many fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak thick platy structure; friable; few roots; medium acid; clear smooth boundary.

C2—47 to 60 inches; dark yellowish brown (10YR 4/4) silt; many fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; few roots; slightly acid.

The solum ranges from 22 to 50 inches in thickness. Below the part that is influenced by agricultural lime, it ranges from very strongly acid to slightly acid.

The Ap horizon is 5 to 9 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. The A2 horizon and the A2 part of the A&B and B&A horizons have color value of 4 to 6 and chroma of 2 or 3. In some pedons the A2 horizon has colors of high chroma similar to those of spodic horizons, but such layers are too thin or too weakly expressed to qualify as spodic horizons.

The B2t horizon and the Bt part of A&B and B&A horizons have hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 3 or 4. They are silt loam or silty clay loam. The B3 and C horizons are dominantly silt loam or silt but have thin strata of silty clay loam and very fine sandy loam in some pedons. The C horizon ranges from strongly acid to neutral.

Campia Variant

The Campia Variant consists of deep, well drained and moderately well drained, moderately slowly permeable soils on glacial lake plains and terraces. These soils formed mostly in stratified, clayey lacustrine sediments. Slope ranges from 2 to 20 percent.

Campia Variant soils are similar to other Campia soils and to Crystal Lake soils and are commonly adjacent to Comstock Variant soils on the landscape. The other Campia soils and the Crystal Lake soils contain less clay in the control section. The somewhat poorly drained Comstock Variant soils are lower on the landscape than the Campia Variant and are less sloping.

Typical pedon of Campia Variant loam, 6 to 12 percent slopes, 460 feet east and 1,220 feet north of the southwest corner of sec. 6, T. 37 N., R. 17 W.

Ap—0 to 6 inches; dark brown (10YR 3/3) loam; weak medium and fine subangular blocky structure; friable; many roots; estimated 2 percent gravel; slightly acid; abrupt smooth boundary.

A2—6 to 7 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; common roots; estimated 2 percent gravel; strongly acid; abrupt broken boundary.

B&A—7 to 11 inches; dark brown (7.5YR 4/4) silty clay loam (Bt); tongues of yellowish brown (10YR 5/4) loam (A2) make up about 35 percent of the matrix; weak medium and fine subangular blocky structure; firm; common roots; medium acid; clear wavy boundary.

B21t—11 to 18 inches; brown (7.5YR 5/4) silty clay; moderate very fine subangular blocky structure; firm; common roots; thin patchy clay films on faces of peds; medium acid; clear wavy boundary.

B22t—18 to 25 inches; brown (7.5YR 5/4) and yellowish brown (10YR 5/4) silty clay; moderate very fine subangular blocky structure; firm; few roots; thin patchy clay films on faces of peds; medium acid; clear wavy boundary.

B3t—25 to 29 inches; brown (7.5YR 5/4) and yellowish brown (10YR 5/4) silty clay; weak medium subangular blocky structure; firm; few roots; thin patchy clay films on vertical faces of peds; neutral; clear wavy boundary.

C—29 to 60 inches; brown (10YR 5/3) and reddish brown (5YR 4/4) stratified silty clay, clay, silt, and fine sand; few fine prominent brownish yellow (10YR 6/8) mottles; weak medium platy structure; firm; few white (10YR 8/1) concretions; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness and the upper loamy sediments from 6 to 20 inches. In some pedons the upper part of the solum ranges from 0 to 5 percent coarse fragments. The part of the solum that is not influenced by agricultural lime ranges from strongly acid to neutral.

The Ap horizon is 6 to 10 inches thick. It has color value of 2 to 4 and chroma of 1 to 3. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. Some have an A&B horizon. The A2 horizon and the A2 part of the B&A and A&B horizons have color value of 4 to 6 and chroma of 2 to 4. They are typically loam or silty clay loam but are sandy loam in some pedons. The B2t horizon and the Bt part of the B&A and A&B horizons have hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. They are typically silty clay or silty clay loam, but in some pedons they have thin strata of silt loam or loam. The C horizon is mildly alkaline or moderately alkaline.

Cathro series

The Cathro series consists of deep, very poorly drained, organic soils that are moderately rapidly permeable in the upper part and moderately slowly permeable in the underlying material. These soils are in depressional areas on glacial lake basins and glacial moraines. They formed in organic material derived from herbaceous plants and in the underlying loamy glacial drift. Slope ranges from 0 to 2 percent.

The Cathro soils in this survey area are more acid in the IIC horizon than is defined as the range for the Cathro series. This difference, however, does not alter the use or behavior of the soils.

Cathro soils are similar to Markey soils and are commonly adjacent to Rifle and Seelyeville soils on the landscape. Markey soils have a sandy IIC horizon. Rifle and Seelyeville soils formed in thick organic deposits and do not have a IIC horizon within a depth of 51 inches.

Typical pedon of Cathro muck, 70 feet north and 1,440 feet west of the southeast corner of sec. 18, T. 36 N., R. 15 W.

Oi1—0 to 1 inch; dark brown (7.5YR 3/2) broken face, dark reddish brown (5YR 2/2) rubbed, fibric material; about 90 percent sphagnum moss fiber; massive; nonsticky; primarily herbaceous fiber; many roots; strongly acid; abrupt smooth boundary.

Oa1—1 inch to 19 inches; dark reddish brown (5YR 3/2) broken face, dark reddish brown (5YR 2/2) rubbed, sapric material; about 30 percent fiber, 8 percent rubbed; weak thick platy structure; nonsticky; primarily herbaceous fiber; estimated 5 percent woody fragments; common roots; medium acid; clear wavy boundary.

Oa2—19 to 35 inches; dark reddish brown (5YR 3/2) broken face, dark reddish brown (5YR 2/2) rubbed, sapric material; about 20 percent fiber, 5 percent rubbed; weak medium platy structure; nonsticky; estimated 5 percent woody fragments; medium acid; clear wavy boundary.

Oa3—35 to 39 inches; very dark grayish brown (10YR 3/2) broken face and rubbed sapric material; about 10 percent fiber, 3 percent rubbed; massive; nonsticky; medium acid; abrupt smooth boundary.

IIC1—39 to 44 inches; dark gray (5Y 4/1) stratified silt and very fine sand; massive; friable; strongly acid; clear smooth boundary.

IIC2—44 to 60 inches; greenish gray (5GY 5/1) stratified silt and very fine sand; few medium prominent reddish yellow (7.5YR 6/6) mottles; massive; friable; strongly acid.

Depth to the IIC horizon ranges from 16 to 50 inches. The fibers are derived mostly from herbaceous plants, but some layers contain moss fibers. Some pedons contain woody fragments, but this material is less than 15 percent of the volume. The organic layers are dominantly sapric material. Some pedons have layers of hemic material, but the total thickness of these layers is less than 10 inches. The organic part of the control section has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 1 or 2. It is strongly acid to slightly acid.

The IIC horizon has hue of 5GY, 5Y, 2.5Y, 10YR, 7.5YR, or 5YR; value of 4 to 6; and chroma of 1 or 2. It is sandy loam, loam, silt loam, silt, or very fine sand and ranges from strongly acid to neutral.

Chetek series

The Chetek series consists of deep, somewhat excessively drained soils that are moderately rapidly permeable in the upper part and rapidly permeable in the lower part. These soils are on outwash plains and stream terraces. They formed in loamy sediments and in the underlying sand and gravel glacial outwash. Slope ranges from 2 to 20 percent.

Chetek soils are similar to Burkhardt, Cromwell, and Rosholt soils and are commonly adjacent to Cromwell Variant, Cushing, and Rosholt soils on the landscape. Burkhardt soils have a mollic epipedon and lack an argillic horizon. Cromwell soils lack an argillic horizon. The somewhat poorly drained Cromwell Variant soils are lower on the landscape than Chetek soils. In some areas Cushing soils are intermingled with Chetek soils in a complex pattern. The well drained Rosholt soils have a thicker solum than Chetek soils.

Typical pedon in an uneroded part of an area of Chetek sandy loam, 6 to 12 percent slopes, eroded, 300 feet north and 1,410 feet east of the center of sec. 2, T 32 N., R. 17 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) sandy loam; weak medium subangular blocky structure parting to weak medium granular; friable; common roots; estimated 5 percent fine gravel; slightly acid; abrupt smooth boundary.

A2—6 to 8 inches; dark brown (10YR 4/3) sandy loam; weak medium subangular blocky structure parting to weak medium platy; friable; one grayish brown (10YR 5/2) tongue, 5 centimeters in diameter and 10 centimeters long, extends through this horizon and into the B2t horizon; many roots; estimated 5 percent fine gravel; slightly acid; clear wavy boundary.

B2t—8 to 17 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of most peds; many roots; estimated 10 percent fine gravel; slightly acid; clear wavy boundary.

IIB3—17 to 21 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; many roots; estimated 15 percent fine gravel; slightly acid; clear irregular boundary.

IIC1—21 to 34 inches; strong brown (7.5YR 5/6) coarse sand and gravel; single grained; loose; few roots; medium acid; clear smooth boundary.

IIC2—34 to 53 inches; yellowish brown (10YR 5/4) coarse sand; single grained; loose; layers of reddish brown (5YR 4/4) and dark brown (7.5YR 4/4) sand and loamy sand no more than 1.5 centimeters thick; few roots; estimated 15 percent fine gravel; medium acid; clear smooth boundary.

IIC3—53 to 60 inches; light yellowish brown (10YR 6/4) coarse sand; single grained; loose; layers of reddish brown (5YR 4/4) and dark brown (7.5YR 4/4) sand and loamy sand no more than 1.5 centimeters thick; few roots; estimated 15 percent fine gravel; medium acid.

The solum ranges from 12 to 24 inches in thickness. The content of coarse fragments ranges from 15 to 35 percent in the IIB3 and IIC horizons. The IIC horizon and the part of the solum that is not influenced by agricultural lime range from strongly acid to slightly acid.

The Ap horizon is 6 to 9 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon, which is 1 inch to 3 inches thick. The A2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3. It is sandy loam or loam. In some pedons plowing has mixed the A2 horizon with the Ap horizon. The B2t horizon has hue of 7.5YR or 5YR and value and chroma of 3 or 4. It is loam or sandy loam. The IIC horizon is stratified sand and gravel or gravelly sand.

Comstock series

The Comstock series consists of deep, somewhat poorly drained, moderately permeable soils on glacial lake plains and terraces. These soils formed in silty eolian or lacustrine sediments. Slope ranges from 0 to 3 percent.

Comstock soils are similar to Plover soils and are commonly adjacent to Barronett and Crystal Lake soils on the landscape. Plover soils contain more sand and less silt and clay in the control section than Comstock soils. The poorly drained Barronett soils are lower on the landscape than Comstock soils, and the moderately well drained Crystal Lake soils are slightly higher on the landscape.

Typical pedon of Comstock silt loam, 0 to 3 percent slopes, 3,840 feet west and 300 feet north of the southeast corner of sec. 22, T. 35 N., R. 15 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; weak and moderate fine subangular blocky structure; friable; many fine fibrous roots; medium acid; clear smooth boundary.

A21—8 to 11 inches; brown (10YR 5/3) silt loam; few medium prominent strong brown (7.5YR 5/6) mottles; moderate medium platy structure; friable; common fine fibrous roots; medium acid; clear smooth boundary.

A22—11 to 15 inches; grayish brown (10YR 5/2) silt loam; many medium distinct strong brown (7.5YR 5/6) mottles; moderate medium platy structure; friable; common fine fibrous roots; strongly acid; clear smooth boundary.

B&A—15 to 21 inches; dark yellowish brown (10YR 4/4) silt loam (Bt); many medium distinct brown (7.5YR 4/4) mottles; moderate fine and medium subangular blocky structure; friable; thin patchy clay films on faces of peds; tongues of brown (10YR 5/3) and grayish brown (10YR 5/2) silt loam (A2) make up about 40 percent of the horizon; common fine fibrous roots; strongly acid; clear smooth boundary.

B21t—21 to 28 inches; dark yellowish brown (10YR 4/4) silt loam; many medium distinct strong brown (7.5YR 5/6) and common medium distinct dark grayish brown (10YR 4/2) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; few fine fibrous roots; thin coatings of light brownish gray (10YR 6/2) silt along primary vertical faces of prisms and connecting to tongues of the A2 horizon; thin patchy clay films on faces of subangular blocky peds and continuous filling in worm holes; strongly acid; clear wavy boundary.

B22t—28 to 34 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; firm; few fine fibrous roots; thin patchy clay films on faces of peds and in worm holes; strongly acid; clear wavy boundary.

B3—34 to 44 inches; yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) silt loam stratified with several 1- to 2-inch bands of fine and very fine sand; weak coarse prismatic structure parting to weak coarse subangular blocky; friable; strongly acid; gradual wavy boundary.

C—44 to 60 inches; yellowish brown (10YR 5/4) stratified silt, silt loam, and very fine sand; weak medium platy structure; friable; strongly acid.

The thickness of the solum typically is 44 inches but ranges from 30 to 59 inches. The part of the solum that is not influenced by agricultural lime ranges from very strongly acid to slightly acid.

The Ap horizon is 6 to 9 inches thick. It has color value of 3 or 4 and chroma of 1 or 2. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. Some have an A&B horizon. The A2 horizon and the A2 part of the B&A and A&B horizons have color value of 4 to 6 and chroma of 2 or 3. In some pedons the upper part of the A2 horizon has colors of high chroma similar to those of spodic horizons, but such layers are too thin or too weakly expressed to qualify as spodic horizons.

The B2t horizon and the Bt part of the B&A and A&B horizons have hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 3 or 4. They are silt loam or light silty clay loam. The B3 and C horizons are dominantly silt, silt loam, and very fine sand but have thin strata of silty clay loam, very fine sandy loam, or fine sand. The C horizon ranges from strongly acid to slightly acid.

Comstock Variant

The Comstock Variant consists of deep, somewhat poorly drained, moderately slowly permeable soils on glacial lake plains and terraces. These soils formed in loamy sediments and in stratified, dominantly clayey, lacustrine sediments. Slope ranges from 0 to 3 percent.

Comstock Variant soils are similar to other Comstock soils and are commonly adjacent to Campia Variant soils on the landscape. The other Comstock soils contain less clay in the lower part of the subsoil and in the underlying material. Campia Variant soils are higher on the landscape than Comstock Variant soils and are more sloping.

Typical pedon of Comstock Variant loam, 0 to 3 percent slopes, 1,660 feet east and 50 feet south of the northwest corner of sec. 6, T. 37 N., R. 17 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam; weak medium and fine subangular blocky structure; very friable; common roots; estimated 1 percent gravel; slightly acid; abrupt smooth boundary.

A2—7 to 10 inches; pale brown (10YR 6/3) fine sandy loam; few fine prominent brownish yellow (10YR 6/8) mottles; weak thin platy structure parting to weak very fine subangular blocky; very friable; few roots; estimated 1 percent gravel; slightly acid; clear wavy boundary.

B&A—10 to 14 inches; brown (7.5YR 5/4) sandy loam (Bt); few fine prominent brownish yellow (10YR 6/8) and few fine distinct grayish brown (10YR 5/2) mottles; tongues of pale brown (10YR 6/3) fine sandy loam (A2) make up about 30 percent of the horizon; weak medium subangular blocky structure; very friable; few roots; estimated 3 percent gravel; slightly acid; abrupt wavy boundary.

IIB21t—14 to 23 inches; brown (10YR 5/3) silty clay; common fine prominent reddish yellow (7.5YR 6/8) and few medium faint light brownish gray (10YR 6/2) mottles; moderate medium and fine subangular blocky structure; firm; few roots; thin patchy dark yellowish brown (10YR 3/4) clay films; medium acid; clear wavy boundary.

IIB22t—23 to 30 inches; brown (10YR 5/3) silty clay; few fine prominent reddish yellow (7.5YR 6/8) and few fine faint light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; few roots; thin patchy clay films; medium acid; clear wavy boundary.

IIB3—30 to 34 inches; yellowish brown (10YR 5/4) silty clay; few fine prominent reddish yellow (7.5YR 6/8) and few fine distinct light olive gray (5Y 6/2) mottles; weak coarse subangular blocky structure; firm; slightly acid; clear wavy boundary.

IIC—34 to 60 inches; light yellowish brown (2.5Y 6/4) silty clay; few fine distinct yellowish brown (10YR 5/6) mottles; weak thick platy structure; firm; few thin layers of reddish brown (5YR 5/4) silt; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness and the upper loamy material from 12 to 24 inches. The part of the solum that is not influenced by agricultural lime ranges from strongly acid to slightly acid. The content of coarse fragments ranges from 0 to 5 percent in the upper loamy material.

The Ap horizon is 6 to 10 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. Some have an A&B horizon. The A2 horizon and the A2 part of the B&A and A&B horizons have color value of 4 to 6 and chroma of 2 or 3. They are dominantly sandy loam, fine sandy loam, or loam but are silty clay loam in a few pedons.

The Bt part of the B&A and A&B horizons has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 3 to 5. It is sandy loam, fine sandy loam, or loam. The IIB2t horizon has hue of 10YR, 7.5YR, or 5YR; value of 4 to 6; and chroma of 3 or 4. It is dominantly silty clay or silty clay loam but in some pedons has thin strata of silt loam or very fine sandy loam.

The IIC horizon is dominantly silty clay or silty clay loam but in many pedons has thin lenses of silt, silt loam, fine sand, or very fine sand. It ranges from neutral to moderately alkaline.

Cromwell series

The Cromwell series consists of deep, somewhat excessively drained soils that are moderately permeable in the upper part and rapidly permeable in the lower part. These soils are on outwash plains. They formed in loamy and sandy sediments and in the underlying glacial outwash. Slope ranges from 0 to 30 percent.

Cromwell soils are similar to Chetek soils and are commonly adjacent to Cromwell Variant, Menahga, and Rosholt soils on the landscape. Chetek soils have an argillic horizon. The somewhat poorly drained Cromwell Variant soils are in the lower positions on the landscape. Menahga soils are somewhat excessively drained and Rosholt soils well drained.

Typical pedon of Cromwell sandy loam, 2 to 6 percent slopes, 1,600 feet north and 3,600 feet east of the southwest corner of sec. 11, T. 36 N., R. 16 W.

A1—0 to 1 inch; black (10YR 2/1) sandy loam; moderate medium granular structure; very friable; high content of organic matter; estimated less than 5 percent gravel; many roots; medium acid; abrupt wavy boundary.

A2—1 inch to 3 inches; dark brown (7.5YR 4/2) sandy loam; weak thick platy structure; very friable; estimated less than 5 percent gravel; many roots; medium acid; clear wavy boundary.

B21—3 to 9 inches; dark brown (7.5YR 4/4) sandy loam; moderate fine subangular blocky structure; friable; estimated 10 percent gravel; many roots; medium acid; clear wavy boundary.

B22—9 to 13 inches; dark brown (7.5YR 4/4) sandy loam; moderate fine and medium subangular blocky structure; friable; estimated 12 percent cobbles and 8 percent gravel; many roots; strongly acid; gradual wavy boundary.

B31—13 to 21 inches; dark brown (7.5YR 4/4) cobbly loamy sand; weak thick platy structure; friable; slightly brittle; estimated 5 percent gravel and 15 percent cobbles; many roots; strongly acid; abrupt wavy boundary.

B32—21 to 30 inches; dark brown (7.5YR 4/4) sand; weak thick platy structure in place, single grained when disturbed; very friable; estimated less than 5 percent gravel; few roots; medium acid; clear wavy boundary.

C1—30 to 39 inches; dark brown (7.5YR 4/4) sand; single grained; loose; estimated less than 5 percent gravel; few roots; slightly acid; clear wavy boundary.

C2—39 to 49 inches; dark brown (7.5YR 4/4) sand; single grained; loose; estimated 5 percent gravel; one gravelly sand layer, 3 to 4 centimeters thick, at the lower boundary; few roots; slightly acid; abrupt wavy boundary.

C3—49 to 60 inches; brown (7.5YR 5/4) sand; single grained; loose; estimated less than 1 percent gravel; slightly acid.

The solum ranges from 25 to 40 inches in thickness. The upper part ranges, by volume, from 0 to 10 percent coarse fragments. The lower part and the C horizon range from 10 to 35 percent coarse fragments and from 0 to 20 percent cobbles. The part of the solum that is not influenced by agricultural lime ranges from very strongly acid to medium acid. The lower pH occurs only in the upper part of the solum.

The A1 horizon is 1 inch to 3 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an Ap horizon, which is 5 to 10 inches thick. The A2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3. It is typically sandy loam but is fine sandy loam in some pedons. In some areas plowing has mixed the A2 horizon with the Ap horizon.

The B horizon has hue of 7.5YR or 5YR and value and chroma of 3 or 4. The upper part is sandy loam or fine sandy loam. The lower part is dominantly sand, coarse sand, cobbly loamy sand, or gravelly sand but in some pedons has subhorizons of loamy sand.

The C horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is medium acid or slightly acid.

Cromwell Variant

The Cromwell Variant consists of deep, somewhat poorly drained soils that are moderately rapidly permeable in the upper part and rapidly permeable in the underlying material. These soils are on outwash plains and stream terraces. They formed in loamy sediments and in the underlying sandy glacial outwash. Slope ranges from 0 to 3 percent.

Cromwell Variant soils are commonly adjacent to other Cromwell soils and to Warman Variant soils on the landscape. The other Cromwell soils are somewhat excessively drained and are higher on the landscape. The poorly drained and very poorly drained Warman Variant soils are lower on the landscape.

Typical pedon of Cromwell Variant sandy loam, 0 to 3 percent slopes, 50 feet west and 200 feet north of the southeast corner of sec. 3, T. 36 N., R. 18 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) sandy loam; weak medium subangular blocky structure; friable; few roots; estimated 4 percent gravel; neutral; abrupt smooth boundary.

B2—7 to 16 inches; dark brown (7.5YR 4/4) sandy loam; common medium prominent strong brown (7.5YR 5/8) and few fine distinct brown (7.5YR 5/2) mottles; weak fine subangular blocky structure; friable; few roots; estimated 4 percent gravel; slightly acid; clear wavy boundary.

IIB3—16 to 20 inches; reddish brown (5YR 5/4) loamy sand; common fine prominent strong brown (7.5YR 5/8) and few fine distinct brown (7.5YR 5/2) mottles; weak medium subangular blocky structure; very friable; few roots; estimated 11 percent gravel; medium acid; clear wavy boundary.

IIC1—20 to 34 inches; strong brown (7.5YR 5/6) coarse sand and gravel; single grained; loose; estimated 19 percent gravel; slightly acid; clear wavy boundary.

IIC2—34 to 60 inches; reddish brown (5YR 4/3) coarse sand and gravel; single grained; loose; estimated 22 percent gravel; slightly acid.

The solum ranges from 15 to 30 inches in thickness and the upper loamy sediments from 12 to 20 inches. The content of coarse fragments is, by volume, 0 to 10 percent in the upper part of the solum, 0 to 25 percent in the lower part of the solum, and 10 to 30 percent in the IIC horizon. The upper part of the solum typically contains no cobbles, but the lower part and the IIC horizon range from 0 to 5 percent cobbles. The part of the solum that is not influenced by agricultural lime ranges from medium acid to neutral.

The Ap horizon is 6 to 10 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. The B2 horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is typically sandy loam but is loam in some pedons. The IIB horizon has hue of 7.5YR or 5YR and value and chroma of 4 to 6. It is loamy sand, gravelly loamy sand, or gravelly sandy loam. The IIC horizon is gravelly sand or stratified coarse sand and gravel. It is slightly acid or neutral.

Croswell series

The Croswell series consists of deep, moderately well drained, rapidly permeable soils on outwash plains and stream terraces. These soils formed in sandy glacial outwash. Slope ranges from 0 to 3 percent.

Croswell soils are similar to Menahga and Omega soils and are commonly adjacent to Lino and Omega soils on the landscape. The somewhat excessively drained Menahga and Omega soils are not mottled within a depth of 40 inches. They are higher on the landscape than Croswell soils. The somewhat poorly drained Lino soils are lower on the landscape.

Typical pedon of Croswell loamy sand, 0 to 3 percent slopes, 230 feet west and 1,080 feet south of the northeast corner of sec. 17, T. 36 N., R. 19 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand; weak medium and fine subangular blocky structure; very friable; common roots; neutral; abrupt smooth boundary.

B21ir—8 to 21 inches; brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; very friable; few roots; medium acid; clear wavy boundary.

B22ir—21 to 29 inches; strong brown (7.5YR 5/6) sand; few medium distinct yellowish red (5YR 5/8) mottles; weak coarse subangular blocky structure; very friable; few roots; medium acid; clear wavy boundary.

B31—29 to 32 inches; yellowish red (5YR 5/8) sand; few fine distinct brownish yellow (10YR 6/8) mottles; weak coarse subangular blocky structure; very friable; few roots; medium acid; clear wavy boundary.

B32—32 to 40 inches; reddish yellow (5YR 6/8) sand; common coarse distinct brownish yellow (10YR 6/8) and common fine distinct red (2.5YR 4/6) mottles; weak coarse subangular blocky structure; very friable; few roots; slightly acid; gradual wavy boundary.

C—40 to 60 inches; yellowish brown (10YR 5/6) sand; single grained; loose; slightly acid.

The solum ranges from 24 to 42 inches in thickness. The content of coarse fragments is, by volume, 0 to 5 percent in the solum and the C horizon. The part of the solum that is not influenced by agricultural lime ranges from very strongly acid to slightly acid. The depth to mottles ranges from about 20 to 40 inches.

The Ap horizon is 6 to 10 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. Some pedons have an A2 horizon. The B2ir horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The C horizon ranges from medium acid to neutral.

Crystal Lake series

The Crystal Lake series consists of deep, moderately well drained, moderately permeable soils on glacial lake plains and terraces. These soils formed in silty eolian or lacustrine sediments. Slope ranges from 0 to 6 percent.

Crystal Lake soils are similar to Campia soils and are commonly adjacent to Campia and Comstock soils on the landscape. The well drained Campia soils are higher on the landscape than Crystal Lake soils and are more sloping. The somewhat poorly drained Comstock soils are lower on the landscape.

Typical pedon of Crystal Lake silt loam, 0 to 2 percent slopes, 1,350 feet north and 2,600 feet east of the southwest corner of sec. 22, T. 35 N., R. 15 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; common roots; slightly acid; abrupt smooth boundary.

A2—8 to 12 inches; light brownish gray (10YR 6/2) silt loam; few fine prominent yellowish red (5YR 4/6) mottles; weak thin platy structure; very friable; few roots; medium acid; clear wavy boundary.

B&A—12 to 20 inches; dark yellowish brown (10YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; tongues of light brownish gray (10YR 6/2) silt loam (A2) having weak thin platy structure make up about 30 percent of the matrix; few fine distinct strong brown (7.5YR 5/6) mottles; friable; few roots; thin patchy clay films (Bt); strongly acid; clear wavy boundary.

B2t—20 to 26 inches; dark yellowish brown (10YR 4/4) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; few roots; thin patchy clay films; uncoated silt grains along vertical faces of peds; strongly acid; clear wavy boundary.

B3t—26 to 32 inches; dark yellowish brown (10YR 4/4) silt loam and a few thin strata of very fine sandy loam; common fine distinct pale brown (10YR 6/3) and common fine prominent brownish yellow (10YR 6/8) mottles; weak medium subangular blocky structure; friable; few roots; thin patchy clay films, mainly on vertical faces of peds and in pores and root channels; uncoated silt grains on vertical faces of a few peds; strongly acid; clear wavy boundary.

C—32 to 60 inches; yellowish brown (10YR 5/4) silt loam and thin strata of very fine sand; many fine distinct light brownish gray (10YR 6/2), few medium prominent brownish yellow (10YR 6/8), and few fine distinct strong brown (7.5YR 5/6) mottles; weak thick platy structure; friable; medium acid.

The solum ranges from 22 to 50 inches in thickness. Below the part that is influenced by agricultural lime, it ranges from very strongly acid to medium acid.

The Ap horizon is 5 to 9 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. Some have an A&B horizon. The A2 horizon and the A2 part of the B&A and A&B horizons have color value of 4 to 6 and chroma of 2 or 3. In some pedons the A2 horizon has colors of high chroma similar to those of spodic horizons, but such layers are too thin or too weakly expressed to qualify as spodic horizons.

The B2t horizon and the Bt part of the B&A and A&B horizons have hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 3 or 4. They are silt loam or silty clay loam. The B horizon has few to many high chroma mottles. The B3t and C horizons are dominantly silt loam but in some pedons have thin strata of silty clay loam, silt, fine or very fine sandy loam, or fine or very fine sand. The C horizon ranges from slightly acid to very strongly acid. It has few to many low chroma mottles.

Cushing series

The Cushing series consists of deep, well drained and moderately well drained, moderately slowly permeable soils on glacial uplands. These soils formed in loamy glacial till. Slope ranges from 2 to 30 percent.

Cushing soils are similar to Santiago soils and are commonly adjacent to Alstad, Bluffton, and Chetek soils on the landscape. The somewhat poorly drained Alstad soils and the poorly drained and very poorly drained Bluffton soils are in shallow depressions, along drainageways, or in slightly lower areas than Cushing soils. The excessively well drained Chetek soils formed in loamy sediments and in the underlying sand and gravel glacial outwash. They are intermingled with Cushing soils in a complex pattern. Santiago soils are more acid than Cushing soils. They are underlain with sandy loam glacial till.

Typical pedon of Cushing loam, 2 to 6 percent slopes, 30 feet north and 300 feet west of the southeast corner of sec. 18, T. 36 N., R. 18 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam; weak very fine subangular blocky structure; friable; many fine fibrous roots; neutral; abrupt smooth boundary.

A2—9 to 16 inches; brown (10YR 5/3) loam; weak thin platy structure; friable; common fine fibrous roots; neutral; clear wavy boundary.

B&A—16 to 20 inches; dark brown (7.5YR 4/4) loam (Bt); moderate medium subangular blocky structure; firm; common thin clay films on faces of peds and in tubular pores; tongues of brown (10YR 5/3) loam (A2) make up about 25 percent of the horizon; weak thin platy structure; friable; common fine fibrous roots; neutral; clear wavy boundary.

B21t—20 to 29 inches; dark brown (7.5YR 4/4) sandy clay loam; moderate fine and medium subangular blocky structure; firm; common thin clay films on faces of peds; grayish brown (10YR 5/2) coatings on vertical faces of some peds; estimated 5 percent gravel; common fine fibrous roots; neutral; clear smooth boundary.

B22t—29 to 42 inches; dark brown (7.5YR 4/4) sandy clay loam; common medium prominent strong brown (7.5YR 5/8) mottles at a depth of 33 to 35 inches; weak medium and coarse subangular blocky structure; firm; thin patchy clay films on faces of peds; grayish brown (10YR 5/2) coatings on primary vertical cleavage planes; few fine fibrous roots; estimated 5 percent gravel; medium acid; gradual wavy boundary.

C—42 to 60 inches; dark brown (10YR 4/3) loam; massive in place, weak thick platy structure if disturbed; estimated 7 percent gravel; firm; slightly acid.

The solum ranges from 24 to 50 inches in thickness. Below the part that is influenced by agricultural lime, it ranges from strongly acid to neutral. The content of coarse fragments ranges from 0 to 5 percent in the solum and from 5 to 15 percent in the C horizon. The content of cobbles ranges from 0 to 3 percent in the A horizon and from 0 to 5 percent in the B and C horizons. Mottles are at a depth of 30 to 60 inches in some pedons.

The Ap horizon is 6 to 9 inches thick. It has color value of 2 or 3 and chroma of 1 to 3. It is typically loam, but it can be sandy clay loam or clay loam in severely eroded areas. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. Some have an A&B horizon. The A2 horizon and the A2 part of the A&B and B&A horizons have color value of 4 to 6 and chroma of 2 or 3. The eroded soils generally do not have an A2 horizon.

The B2t horizon and the Bt part of the A&B and B&A horizons have hue of 10YR or 7.5YR and value and chroma of 4 or 5. They are loam, sandy clay loam, or clay loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It ranges from slightly acid to moderately alkaline. It is typically loam but is sandy clay loam or clay loam in some pedons.

Dakota series

The Dakota series consists of deep, well drained soils that are moderately permeable in the upper part and very rapidly permeable in the underlying material. These soils are on glacial outwash plains and stream terraces. They formed in loamy sediments and in the underlying sand and gravel glacial outwash. Slope ranges from 0 to 6 percent.

The mean annual temperature of the Dakota soils in this survey area is a few degrees lower than is defined as the range for the Dakota series. This difference, however, does not alter the use or behavior of the soils.

Dakota soils are similar to Antigo and Rosholt soils and are commonly adjacent to Burkhardt and Dakota Variant soils on the landscape. Antigo and Rosholt soils have an ochric epipedon. The somewhat excessively drained Burkhardt soils have a thinner solum than Dakota soils and are intermingled with those soils. The somewhat poorly drained Dakota Variant soils are slightly lower on the landscape.

Typical pedon of Dakota loam, 0 to 2 percent slopes, 1,380 feet west and 2,580 feet north of the southeast corner of sec. 4, T. 32 N., R. 19 W.

Ap—0 to 10 inches; very dark brown (10YR 2/2) loam; moderate fine granular structure; friable; common roots; neutral; abrupt smooth boundary.

A12—10 to 16 inches; very dark grayish brown (10YR 3/2) loam; moderate very fine granular structure; friable; estimated 2 percent gravel; common roots; neutral; clear wavy boundary.

B21t—16 to 25 inches; dark brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; estimated 3 percent gravel; thin patchy clay films on faces of some peds; few roots; neutral; gradual wavy boundary.

B22t—25 to 30 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; very friable; estimated 8 percent gravel; thin patchy clay films on faces of some peds; few roots; slightly acid; gradual wavy boundary.

IIB31t—30 to 33 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; estimated 11 percent gravel; some clay bridging between sand grains; few roots; medium acid; clear wavy boundary.

IIB32—33 to 38 inches; strong brown (7.5YR 5/6) sand; single grained; loose; estimated 11 percent gravel; medium acid; abrupt wavy boundary.

IIC—38 to 60 inches; light yellowish brown (10YR 6/4) stratified sand, coarse sand, and gravel; single grained; loose; medium acid.

The solum ranges from 28 to 45 inches in thickness and the depth to loamy sand or sand from 24 to 40 inches. The mollic epipedon ranges from 10 to 17 inches in thickness. The content of coarse fragments ranges from 0 to 15 percent in the upper part of the profile and from 0 to 30 percent in the IIB3t and IIC horizons. The IIC horizon and the part of the solum that is not influenced by agricultural lime range from strongly acid to neutral. Some pedons have dolomitic limestone bedrock within a depth of 40 to 60 inches.

The Ap and A12 horizons have color value of 2 or 3 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is dominantly loam or sandy clay loam but has thin subhorizons of clay loam in some pedons. The IIB3 horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is loamy sand, sandy loam, sand, gravelly loamy sand, or gravelly sand. The IIC horizon has color value of 4 to 6 and chroma of 2 to 5. It is stratified sand and gravel or gravelly or very gravelly sand or coarse sand.

Dakota Variant

The Dakota Variant consists of deep, somewhat poorly drained soils that are moderately permeable in the upper part and very rapidly permeable in the underlying material. These soils are on outwash plains and stream terraces. They formed in loamy sediments and in the underlying sand and gravel glacial outwash. Slope ranges from 0 to 3 percent.

Dakota Variant soils are similar to Brill and Poskin soils and are commonly adjacent to Burkhardt, other Dakota, and Hubbard soils on the landscape. The moderately well drained Brill and somewhat poorly drained Poskin soils have an ochric epipedon. The somewhat excessively drained Burkhardt and Hubbard soils and the well drained Dakota soils are slightly higher on the landscape.

Typical pedon of Dakota Variant silt loam, 0 to 3 percent slopes, 1,520 feet east and 1,340 feet south of the northwest corner of sec. 3, T. 32 N., R. 19 W.

A1—0 to 8 inches; black (10YR 2/1) silt loam; moderate medium granular structure; friable; estimated 2 percent gravel; many roots; medium acid; clear wavy boundary.

A3—8 to 13 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; friable; estimated 2 percent gravel; common roots; medium acid; clear wavy boundary.

B21t—13 to 20 inches; dark brown (10YR 4/3) loam; common medium and fine faint grayish brown (10YR 5/2) and common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; friable; thin patchy clay films on faces of some peds; estimated 6 percent gravel; common roots; medium acid; clear wavy boundary.

B22t—20 to 29 inches; dark yellowish brown (10YR 4/4) loam; common medium distinct grayish brown (10YR

5/2) and strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; very friable; thin patchy clay films on faces of some peds; estimated 10 percent gravel; few roots; medium acid; clear wavy boundary.

IIB3—29 to 34 inches; brown (10YR 5/3) gravelly loamy coarse sand; few fine prominent yellowish brown (10YR 5/6) mottles; single grained; loose; few roots; estimated 16 percent gravel; few roots; slightly acid; clear wavy boundary.

IIC—34 to 60 inches; light yellowish brown (10YR 6/4) stratified sand and gravel; single grained; loose; black (5YR 2/1) stains on sand and gravel particles in some strata; slightly acid.

The solum ranges from 24 to 40 inches in thickness and the depth to glacial outwash from 20 to 36 inches. The upper part of the profile ranges from 0 to 10 percent coarse fragments. The IIB3 and IIC horizons range from 10 to 40 percent coarse fragments and from 0 to 10 percent cobbles. The mollic epipedon ranges from 10 to 17 inches in thickness. The part of the solum that is not influenced by agricultural lime ranges from medium acid to neutral.

The A1 horizon has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an Ap horizon. The B2t horizon has hue of 10YR or 7.5YR and value and chroma of 3 to 5. It is loam, sandy loam, or sandy clay loam. The IIBt horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is loamy sand, sandy loam, gravelly loamy sand, gravelly sandy loam, or gravelly loamy coarse sand. The IIC horizon is stratified sand and gravel or gravelly coarse sand. It is slightly acid or neutral.

Emmert series

The Emmert series consists of deep, excessively drained, very rapidly permeable soils on kames and eskers on pitted outwash plains. These soils formed in glacial outwash sand and gravel. Slope ranges from 12 to 35 percent.

Emmert soils are commonly intermingled with Chetek, Cromwell, and Menahga soils on the landscape. These adjacent soils are somewhat excessively drained.

Typical pedon of Emmert gravelly sandy loam, 12 to 35 percent slopes, 380 feet east and 520 feet north of the southwest corner of sec. 8, T. 37 N., R. 17 W.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam; weak fine granular structure; very friable; many roots; estimated 16 percent gravel and 2 percent cobbles; slightly acid; abrupt smooth boundary.

C1—3 to 15 inches; reddish brown (5YR 4/4) gravelly coarse sand; single grained; loose; few roots; estimated 50 percent gravel and 5 percent cobbles; slightly acid; clear wavy boundary.

C2—15 to 60 inches; strong brown (7.5YR 5/6) stratified sand and gravel; single grained; loose; estimated 10 percent cobbles; slightly acid.

The A1 horizon is 2 to 5 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. It ranges, by volume, from 15 to 45 percent coarse fragments and is strongly acid to slightly acid. The C horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 3 to 6. It is sand and gravel or gravelly or very gravelly coarse sand. It ranges, by volume, from 55 to 75 percent coarse fragments and from 0 to 10 percent cobbles. It is typically slightly acid but ranges from strongly acid to neutral.

Freeon series

The Freeon series consists of deep, moderately well drained, moderately permeable or moderately slowly permeable soils on glacial uplands. These soils formed in silty sediments and in the underlying sandy loam glacial till. Slope ranges from 2 to 6 percent.

Freeon soils are commonly adjacent to Adolph, Amery, Auburndale, Magnor, and Santiago soils on the landscape. The very poorly drained Adolph and poorly drained Auburndale soils are in depressional areas and are less sloping than Freeon soils. The well drained Amery and Santiago soils are higher on the landscape than Freeon soils and are more sloping. The somewhat poorly drained Magnor soils are slightly lower on the landscape than Freeon soils or are in concave areas.

Typical pedon of Freeon silt loam, 2 to 6 percent slopes, 60 feet west and 180 feet north of the southeast corner of sec. 27, T. 37 N., R. 16 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; very friable; many roots; neutral; abrupt smooth boundary.

A2—8 to 12 inches; brown (10YR 5/3) silt loam; moderate thin platy structure; very friable; few roots; neutral; clear wavy boundary.

A&B—12 to 18 inches; brown (10YR 5/3) silt loam (A2); few fine prominent reddish yellow (7.5YR 6/6) mottles; weak thin platy structure; very friable; about 60 percent of the horizon occurs as tongues extending into or completely surrounding isolated remnants of brown (7.5YR 5/4) silt loam (Bt); weak fine subangular blocky structure; friable; thin patchy clay films on faces of some peds; few roots; slightly acid; clear wavy boundary.

B&A—18 to 22 inches; brown (7.5YR 5/4) silt loam (Bt); few fine distinct reddish yellow (7.5YR 6/6) mottles; moderate medium subangular blocky structure; friable; tongues of brown (10YR 5/3) silt loam (A2) make up about 30 percent of the horizon; weak thin platy structure; very friable; thin patchy clay films on faces of some peds; few roots; slightly acid; clear wavy boundary.

B21t—22 to 27 inches; brown (7.5YR 5/4) silt loam; common medium faint pale brown (10YR 6/3) and common medium distinct reddish yellow (7.5YR 6/6) mottles; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; brown (10YR 5/3) coatings (A2) on some primary vertical faces of peds; few roots; medium acid; clear wavy boundary.

IIB22t—27 to 34 inches; reddish brown (5YR 5/4) sandy loam; common medium distinct pale brown (10YR 6/3) and common medium prominent light yellowish brown (2.5Y 6/4) mottles; weak medium subangular blocky structure; firm; thin patchy clay films on faces of some peds; estimated 9 percent gravel and 2 percent cobbles; few roots; medium acid; clear wavy boundary.

IIC—34 to 60 inches; reddish brown (2.5YR 4/4) sandy loam; massive; firm; estimated 8 percent gravel and 2 percent cobbles; slightly acid.

The solum ranges from 24 to 40 inches in thickness and the depth to glacial till from 15 to 30 inches. The IIB and IIC horizons range, by volume, from 8 to 20 percent coarse fragments. They have a bulk density of more than 1.7 grams per cubic centimeter. The part of the solum that is not influenced by agricultural lime ranges from very strongly acid to slightly acid.

The Ap horizon is 5 to 9 inches thick. It has color value of 3 or 4 and chroma of 1 or 2. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. The A2 horizon and the A2 part of the A&B or B&A horizons have color value of 4 to 6 and chroma of 2 or 3. They are silt loam or silt.

The B2t horizon and the Bt part of the A&B and B&A horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 5. They are silt loam or silty clay loam. The IIB2t horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly loam, sandy clay loam, or sandy loam but is fine sandy loam in a few pedons. Some pedons have a IIB3 horizon.

The IIC horizon has hue of 2.5YR or 5YR and value and chroma of 3 to 5. It is typically sandy loam but in some pedons is loamy sand or loam. It ranges from medium acid to neutral.

Hubbard series

The Hubbard series consists of deep, somewhat excessively drained, rapidly permeable soils on outwash plains and stream terraces. Slope ranges from 0 to 6 percent.

Hubbard soils are similar to Menahga and Nymore soils and are commonly adjacent to Burkhardt and Dakota soils on the landscape. Menahga and Nymore soils have a thinner or lighter colored surface layer than Hubbard soils. Burkhardt soils have a heavier textured solum than Hubbard soils and contain more gravel in the solum and the C horizon. The well drained Dakota soils have an argillic horizon.

Typical pedon of Hubbard loamy sand, 0 to 6 percent slopes, 1,970 feet north and 600 feet west of the southeast corner of sec. 22, T. 33 N., R. 19 W.

Ap—0 to 11 inches; very dark brown (10YR 2/2) loamy sand; weak fine granular structure; very friable; common roots; slightly acid; abrupt smooth boundary.

A12—11 to 18 inches; very dark brown (10YR 2/2) loamy sand; weak medium subangular blocky structure; very friable; common roots; slightly acid; clear wavy boundary.

AC—18 to 24 inches; dark brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; very friable; few roots; estimated 1 percent gravel; slightly acid; clear wavy boundary.

C1—24 to 35 inches; dark brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; very friable; few roots; estimated 1 percent gravel; slightly acid; gradual wavy boundary.

C2—35 to 60 inches; dark yellowish brown (10YR 4/4) sand; single grained; loose; estimated 3 percent gravel; slightly acid.

The mollic epipedon ranges from 10 to 22 inches in thickness. The content of coarse fragments ranges from 0 to 5 percent in the A horizon and from 0 to 10 percent of the C horizon.

The A horizon has color value of 2 or 3 and chroma of 1 or 2. It is medium acid or slightly acid. Some pedons have an A3 horizon. The AC horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is dominantly sand or coarse sand, but the upper part is loamy sand or loamy coarse sand in some pedons. The C horizon is sand or coarse sand and is slightly acid or neutral.

Lino series

The Lino series consists of deep, somewhat poorly drained, rapidly permeable soils on outwash plains and stream terraces. These soils formed in sandy glacial outwash. Slope ranges from 0 to 3 percent.

The Lino soils in this survey area have a redder C horizon than is defined as the range for the Lino series. This difference, however, does not alter the use or behavior of the soils.

Lino soils are similar to Croswell and Newson soils and are commonly adjacent to Croswell, Newson, and Omega soils on the landscape. The moderately well drained Croswell and somewhat excessively drained Omega soils are slightly higher on the landscape than

Lino soils. The poorly drained and very poorly drained Newson soils are slightly lower on the landscape.

Typical pedon of Lino loamy fine sand, 0 to 3 percent slopes, 660 feet north and 55 feet west of the southeast corner of sec. 2, T. 36 N., R. 20 W.

O1—1 inch to 0; dark brown (7.5YR 3/2) partly decomposed litter.

A1—0 to 4 inches; very dark brown (10YR 2/2) loamy fine sand; weak medium subangular blocky structure; very friable; common roots; common uncoated sand grains; medium acid; clear wavy boundary.

B1—4 to 18 inches; yellowish brown (10YR 5/4) loamy fine sand; few medium faint brown (7.5YR 5/4) mottles; weak coarse subangular blocky structure; very friable; common roots; strongly acid; clear wavy boundary.

B2—18 to 26 inches; pale brown (10YR 6/3) fine sand; few coarse faint light brownish gray (10YR 6/2) and few medium faint brown (7.5YR 5/4) mottles; weak coarse subangular blocky structure parting to single grained; very friable; common roots; strongly acid; clear wavy boundary.

B3—26 to 41 inches; pale brown (10YR 6/3) fine sand; common medium faint light brownish gray (10YR 6/2) and many coarse prominent reddish yellow (7.5YR 6/8) mottles; weak coarse subangular blocky structure parting to single grained; very friable; few roots; strongly acid; clear wavy boundary.

C—41 to 60 inches; reddish brown (5YR 5/3) fine sand; single grained; loose; slightly acid.

The solum ranges from 24 to 50 inches in thickness. Below the part that is influenced by agricultural lime, it is medium acid or strongly acid. It is dominantly fine sand but is sand in some pedons. In some pedons the B horizon and the upper part of the C horizon have few to many mottles.

The A1 horizon is 1 inch to 5 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an Ap horizon, which is 6 to 10 inches thick. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. It is dominantly fine sand but has layers of loamy fine sand in some pedons. The C horizon has hue of 7.5YR or 5YR, value of 5 or 6, and chroma of 2 to 4. It is typically fine sand but is sand in some pedons. It is medium acid or slightly acid.

Magnor series

The Magnor series consists of deep, somewhat poorly drained, moderately slowly permeable soils on glacial uplands. These soils formed in silty sediments and in the underlying sandy loam glacial till. Slope ranges from 0 to 6 percent.

Magnor soils are similar to Alstad soils and are commonly adjacent to Amery, Auburndale, Freeon, and Santiago soils on the landscape. Alstad soils are less acid than Magnor soils and formed in loam glacial till. The well drained Amery and Santiago soils are higher on the landscape than Magnor soils and are more sloping. The poorly drained Auburndale soils are in depressional areas and are less sloping. The moderately well drained Freeon soils are higher on the landscape than Magnor soils.

Typical pedon of Magnor silt loam, 0 to 2 percent slopes, 380 feet west and 1,283 feet north of the southeast corner of sec. 10, T. 32 N., R. 15 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; friable; few roots; slightly acid; abrupt smooth boundary.

A2—9 to 11 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent brownish yellow (10YR 6/6) and common fine prominent strong brown (7.5YR 5/6) mottles; moderate thin platy structure parting to weak very fine subangular blocky; very friable; few roots; slightly acid; clear wavy boundary.

B&A—11 to 18 inches; dark yellowish brown (10YR 4/4) silt loam (Bt); common medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; moderate medium and fine subangular blocky structure; friable; tongues of light brownish gray (10YR 6/2) silt loam (A2) make up about 40 percent of the horizon; moderate thin platy structure; thin patchy clay films on faces of some peds (Bt); medium acid; clear wavy boundary.

IIB21t—18 to 22 inches; brown (7.5YR 4/4) loam; common fine and medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; few roots; estimated 5 percent gravel; thin patchy clay films on faces of peds; strongly acid; abrupt wavy boundary.

IIB22t—22 to 32 inches; reddish brown (5YR 4/4) sandy loam; few fine distinct light reddish brown (5YR 6/3) and few medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; few roots; estimated 7 percent gravel; thin patchy clay films on faces of some peds; strongly acid; abrupt wavy boundary.

IIC—32 to 60 inches; reddish brown (5YR 5/4) sandy loam; few medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; estimated 10 percent gravel; slightly acid.

The solum ranges from 30 to 50 inches in thickness and the depth to glacial till from 15 to 30 inches. The content of coarse fragments ranges from 0 to 4 percent in the upper part of the solum and from 5 to 12 percent in the IIB and IIC horizons. The content of cobbles ranges from 0 to 4 percent in the upper part of the profile and from 0 to 10 percent in the IIB and IIC horizons. The part of the solum that is not influenced by agricultural lime ranges from strongly acid to slightly acid. The IIB and IIC horizons have a bulk density of more than 1.7 grams per cubic centimeter. The solum and the IIC horizon have faint to prominent mottles.

The Ap horizon is 6 to 10 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon. This horizon is 2 to 4 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an A&B horizon. The A2 horizon and the A2 part of the B&A and A&B horizons have color value of 4 to 6 and chroma of 2 or 3. They are silt loam or silt.

The Bt part of the B&A and A&B horizons and the B21t horizon, which occurs in some pedons, have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are loam or silt loam. The IIB2t horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6.

The IIC horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 4 or 5; and chroma of 3 to 6. It ranges from strongly acid to slightly acid.

Markey series

The Markey series consists of deep, very poorly drained, organic soils that are moderately rapidly permeable in the organic part and rapidly permeable in the underlying material. These soils are in bogs in depressional areas on outwash plains, glacial lake basins, and glacial moraines. They formed in organic material derived from herbaceous plants and in the underlying sandy glacial outwash. Slope ranges from 0 to 2 percent.

Markey soils are similar to Cathro soils and are commonly adjacent to Newson, Rifle, and Seelyeville soils on the landscape. Cathro soils have a loamy IIC horizon. Newson soils are sandy throughout. Rifle and Seelyeville soils do not have a IIC horizon within a depth of 51 inches.

Typical pedon of Markey muck, 1,240 feet north and 2,080 feet east of the southwest corner of sec. 8, T. 32 N., R. 17 W.

Oa1—0 to 12 inches; black (2.5YR 2/0) broken face and rubbed sapric material; about 23 percent fibers, 5 percent rubbed; weak coarse subangular blocky structure; slightly sticky; primarily herbaceous fibers; estimated 12 percent mineral content; medium acid; clear smooth boundary.

Oa2—12 to 31 inches; black (10YR 2/1) broken face and rubbed sapric material; about 15 percent fibers, 5 percent rubbed; weak medium and coarse subangular blocky structure; nonsticky; primarily herbaceous fibers; medium acid; clear wavy boundary.

Oa3—31 to 35 inches; very dark gray (10YR 3/1) broken face and rubbed sapric material; about 12 percent fibers, 3 percent rubbed; massive; nonsticky; primarily herbaceous fibers; slightly acid; clear wavy boundary.

IIC—35 to 60 inches; grayish brown (10YR 5/2) sand; single grained; loose; neutral.

Depth to the IIC horizon ranges from 16 to 50 inches. The fibers are mostly derived from herbaceous plants, but some layers contain moss fibers. Some pedons contain woody fragments, but this material is less than 15 percent of the volume. The organic layers are dominantly sapric material, but some pedons have thin layers of hemic material totaling less than 10 inches thick. The organic layer has hue of 2.5YR, 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 0 to 3. It is medium acid or slightly acid.

The IIC horizon is sand or loamy sand and in some pedons contains some gravel. It has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is slightly acid or neutral.

Menahga series

The Menahga series consists of deep, somewhat excessively drained, rapidly permeable soils on outwash plains. These soils formed in sandy glacial outwash. Slope ranges from 1 to 25 percent.

Menahga soils are similar to Omega soils and are commonly adjacent to Cromwell, Croswell, and Lino soils on the landscape. Omega soils formed in fine sand. The upper part of Cromwell soils is sandy loam. The moderately well drained Croswell and somewhat poorly drained Lino soils are slightly lower on the landscape than Menahga soils.

Typical pedon of Menahga loamy sand, 12 to 25 percent slopes, 240 feet south and 2,480 feet west of the northeast corner of sec. 17, T. 36 N., R. 17 W.

A1—0 to 1 inch; black (10YR 2/1) loamy sand; weak medium granular structure; very friable; common roots; estimated 2 percent gravel; common uncoated sand grains; medium acid; abrupt smooth boundary.

A2—1 inch to 3 inches; dark grayish brown (10YR 4/2) loamy sand; weak medium subangular blocky structure; very friable; common roots; estimated 2 percent gravel; medium acid; abrupt wavy boundary.

B2—3 to 11 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; common roots; estimated 5 percent gravel; medium acid; clear wavy boundary.

B3—11 to 25 inches; brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; few roots; estimated 8 percent gravel; medium acid; clear wavy boundary.

C—25 to 60 inches; brown (7.5YR 5/4) sand; single grained; loose; estimated 9 percent gravel; slightly acid.

The solum ranges from 20 to 40 inches in thickness. Below the part that is influenced by agricultural lime, it ranges from very strongly acid to medium acid. The content of coarse fragments ranges, by volume, from 0 to 15 percent in the solum and the C horizon.

The A1 horizon is 1 inch to 4 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an Ap horizon, which is 8 to 12 inches thick. The A2 horizon has color value of 4 or 5 and chroma of 1 or 2. It is loamy sand or sand. Some pedons have no A2 horizon. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is coarse sand, sand, or loamy sand. The C horizon is sand or coarse sand. It is typically slightly acid, but it ranges to very strongly acid.

Mora series

The Mora series consists of deep, somewhat poorly drained, moderately slowly permeable soils on glacial uplands. These loamy soils are underlain by sandy loam glacial till. Slope ranges from 1 to 4 percent.

The Mora soils in this survey area do not have a fragipan. As a result, they are a taxadjunct to the Mora series. This difference, however, does not alter their use or behavior; the soils have some of the properties of fragipans, such as high bulk density and firm consistence.

Mora soils are similar to Magnor soils and are commonly adjacent to Adolph, Amery, and Freeon soils on the landscape. The very poorly drained Adolph soils are in shallow depressions. The well drained Amery and moderately well drained Freeon soils are slightly higher on the landscape than Mora soils. Magnor soils contain more silt and less sand in the upper part of the profile than Mora soils.

Typical pedon of Mora loam, 1 to 4 percent slopes, 1,740 feet north and 460 feet east of the southwest corner of sec. 29, T. 35 N., R. 15 W.

A1—0 to 3 inches; very dark brown (10YR 2/2) loam; moderate medium granular structure; friable; estimated 2 percent gravel; few stones; common roots; medium acid; abrupt wavy boundary.

A2—3 to 11 inches; brown (10YR 5/3) loam; few medium prominent strong brown (7.5YR 5/6) mottles; weak thin platy structure; very friable; estimated 3 percent gravel; few stones; common roots; strongly acid; clear wavy boundary.

A&B—11 to 22 inches; brown (10YR 5/3) sandy loam (A2); common medium prominent strong brown (7.5YR 5/6) mottles; weak thin platy structure; very friable; approximately 65 percent of the horizon occurs as tongues extending into or completely surrounding isolated remnants of brown (7.5YR 4/4) sandy loam (Bt); weak medium subangular blocky structure; friable; thin patchy clay films on faces of some peds; estimated 5 percent gravel; few stones; few roots; strongly acid; gradual wavy boundary.

B2t—22 to 27 inches; brown (7.5YR 4/4) sandy loam; common fine distinct brown (7.5YR 5/2) and strong brown (7.5YR 5/6) mottles; weak medium and fine subangular blocky structure; very friable; thin patchy clay films on faces of most peds; estimated 8 percent gravel; few stones; few roots; medium acid; clear wavy boundary.

B3t—27 to 33 inches; reddish brown (5YR 5/4) sandy loam; few medium distinct brown (7.5YR 5/2) mottles; weak medium subangular blocky structure; firm; thin patchy clay films on faces of some peds; estimated 8 percent gravel; few stones; few roots; medium acid; clear wavy boundary.

C—33 to 60 inches; reddish brown (5YR 4/4) sandy loam; massive; firm; estimated 11 percent gravel; few stones; slightly acid.

The solum ranges from 25 to 45 inches in thickness. Below the part that is influenced by agricultural lime, it ranges from strongly acid to slightly acid. The content of coarse fragments ranges from 0 to 20 percent in the B horizon and from 10 to 30 percent in the C horizon. The lower part of the B horizon and the C horizon have a bulk density of more than 1.7 grams per cubic centimeter.

The A1 horizon is 2 to 5 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an Ap horizon, which is 7 to 10 inches thick. The A2 horizon and the A2 part of the A&B horizon have color value of 4 to 6 and chroma of 2 or 3. In some pedons the A2 horizon has colors of high chroma similar to those of spodic horizons, but it is too thin or too weakly expressed to qualify as a spodic horizon. In some pedons plowing has mixed the A2 horizon with the Ap horizon.

The B2t horizon and the Bt part of the A&B horizon have hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 2 to 5. They are dominantly loam or sandy loam but are fine sandy loam in some pedons. The B2t horizon has few to many mottles with chroma of 1 or 2.

The C horizon has hue of 7.5YR, 5YR, or 2.5YR and value and chroma of 3 to 6. It is medium acid or slightly acid. It is typically sandy loam but is fine sandy loam in some pedons.

Newson series

The Newson series consists of deep, poorly drained and very poorly drained, rapidly permeable soils on outwash plains and stream terraces. These soils formed in sandy outwash sediments. Slope ranges from 0 to 2 percent.

Newson soils are commonly adjacent to Lino and Markey soils on the landscape. The somewhat poorly drained Lino soils are higher on the landscape than

Newson soils. The very poorly drained Markey soils formed in organic sediments and are slightly lower on the landscape.

Typical pedon of Newson loamy fine sand, 760 feet north and 300 feet west of the southeast corner of sec. 2, T. 36 N., R. 20 W.

O1—1 1/2 inches to 1/2 inch; dark brown (7.5YR 3/2) partly decomposed litter; very strongly acid.

O2—1/2 inch to 0; black (N 2/0) partly decomposed litter; extremely acid.

A1—0 to 8 inches; very dark gray (10YR 3/1) loamy fine sand; weak medium subangular blocky structure; very friable; many roots; many uncoated sand grains; extremely acid; abrupt wavy boundary.

B2g—8 to 24 inches; grayish brown (10YR 5/2) loamy fine sand; common medium prominent brownish yellow (10YR 6/6) mottles; weak fine subangular blocky structure; very friable; few roots; very strongly acid; clear wavy boundary.

C1—24 to 37 inches; light brown (7.5YR 6/4) fine sand; few fine distinct light brownish gray (10YR 6/2) and few coarse distinct brownish yellow (10YR 6/6) mottles; single grained; loose; medium acid; gradual wavy boundary.

C2—37 to 43 inches; light yellowish brown (10YR 6/4) fine sand; few fine distinct light brownish gray (10YR 6/2) and few coarse distinct brownish yellow (10YR 6/6) mottles; single grained; loose; medium acid; clear wavy boundary.

C3—43 to 60 inches; reddish brown (5YR 4/4) fine sand; single grained; loose; slightly acid.

The solum ranges from 20 to 40 inches in thickness and from medium acid to extremely acid.

In some pedons the O horizon is as much as 5 inches thick. The A1 horizon is 6 to 10 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. The B2g horizon has color value of 4 or 5 and chroma of 1 or 2. It is sand, loamy sand, fine sand, or loamy fine sand. It has few to many mottles. The C horizon is dominantly sand or fine sand but is loamy sand in some pedons. It ranges from very strongly acid to slightly acid.

Nymore series

The Nymore series consists of deep, somewhat excessively drained, rapidly permeable soils on outwash plains and stream terraces. These soils formed in sandy glacial outwash. Slope ranges from 0 to 3 percent.

The Nymore soils in this survey area contain finer sand and are redder than is defined as the range for the Nymore series. These differences, however, do not alter the use or behavior of the soils.

Nymore soils are similar to Hubbard, Menahga, and Omega soils and are commonly adjacent to Croswell, Menahga, and Omega soils on the landscape. The moderately well drained Croswell soils are slightly lower on the landscape than Nymore soils. Hubbard soils have a mollic epipedon. Menahga and Omega soils have a thinner or lighter colored surface layer than Nymore soils and are more sloping.

Typical pedon of Nymore fine sand, 0 to 3 percent slopes, 380 feet south and 1,320 feet east of the northwest corner of sec. 33, T. 36 N., R. 19 W.

O1—1 inch to 0; very dark grayish brown (10YR 3/2) partly decomposed litter; strongly acid.

A1—0 to 8 inches; dark brown (7.5YR 3/2) fine sand; weak medium subangular blocky structure; very friable; common roots; strongly acid; gradual wavy boundary.

B1—8 to 15 inches; dark brown (7.5YR 4/4) fine sand; weak medium subangular blocky structure; very friable; common roots; medium acid; clear wavy boundary.

B2—15 to 38 inches; brown (7.5YR 4/4) fine sand; weak coarse subangular blocky structure; very friable; common roots; medium acid; clear wavy boundary.

C1—38 to 60 inches; strong brown (7.5YR 5/6) fine sand; few medium distinct reddish yellow (7.5YR 6/8) mottles at 45 to 60 inches; single grained; loose; few roots; slightly acid.

The solum ranges from 24 to 45 inches in thickness. Below the part that is influenced by agricultural lime, it is medium acid or strongly acid. It is dominantly fine sand, but in some pedons the solum and the C horizon are sand. Typically, these soils contain no coarse fragments, but in some pedons the content of these fragments is, by volume, as much as 10 percent in the solum and the C horizon.

The A1 horizon is 4 to 8 inches thick. It has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. Some pedons have an Ap or A3 horizon. The B horizon has hue of 10YR or 7.5YR and value and chroma of 3 or 4. It is sand or fine sand. The C horizon has hue of 10YR, 7.5YR, or 5YR; value of 5 or 6; and chroma of 4 to 6. It is medium acid or slightly acid.

Omega series

The Omega series consists of deep, somewhat excessively drained, rapidly permeable soils on outwash plains. These soils formed in sandy glacial outwash. Slope ranges from 2 to 20 percent.

Omega soils are similar to Menahga and Nymore soils and are commonly adjacent to Croswell, Lino, Newson, and Nymore soils on the landscape. Menahga soils formed in sand and have no Bir horizon. Nymore soils have a thicker or darker colored A horizon than Omega soils and are less sloping. The moderately well drained Croswell soils, the somewhat poorly drained Lino soils, and the poorly drained and very poorly drained Newson soils are slightly lower on the landscape than Omega soils.

Typical pedon of Omega fine sand, 6 to 12 percent slopes, 2,440 feet north and 240 feet east of the southwest corner of sec. 29, T. 36 N., R. 19 W.

O1—1 inch to 0; very dark grayish brown (10YR 3/2) partly decomposed litter; strongly acid; abrupt wavy boundary.

A1—0 to 2 inches; very dark brown (10YR 2/2) fine sand; weak fine granular structure; very friable; many roots; common uncoated sand grains; medium acid; clear wavy boundary.

B2ir—2 to 21 inches; reddish brown (5YR 4/4) fine sand; weak coarse subangular blocky structure; very friable; common roots; medium acid; gradual wavy boundary.

C—21 to 60 inches; yellowish red (5YR 5/6) fine sand; single grained; loose; few roots to 35 inches; slightly acid.

The solum ranges from 15 to 30 inches in thickness. Below the part that is influenced by agricultural lime, it ranges from very strongly acid to slightly acid. The solum and the C horizon typically contain no coarse fragments, but in some pedons the content of these fragments is as much as 10 percent.

The A1 horizon is 1 inch to 3 inches thick. 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, which is 6 to 10 inches thick. Most have no A2 horizon, but the A1 horizon commonly has uncoated sand grains in the lower part. The B2ir horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 3 to 5; and chroma of 3 or 4. The C horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 5 or 6; and chroma of 3 to 6. It ranges from strongly acid to neutral. It is typically fine sand but is sand in some pedons.

Plover series

The Plover series consists of deep, somewhat poorly drained, moderately permeable soils on glacial lake plains and terraces. These soils formed in stratified loamy and sandy lacustrine sediments. Slope ranges from 0 to 3 percent.

Plover soils are similar to Comstock soils and are commonly adjacent to Alban and Barronett Variant soils on the landscape. Comstock soils contain more silt and clay in the control section than Plover soils. The well drained Alban soils are higher on the landscape than Plover soils and are more sloping. The poorly drained Barronett Variant soils are lower on the landscape.

Typical pedon of Plover fine sandy loam, 0 to 3 percent slopes, 1,355 feet south and 2,600 feet east of the northwest corner of sec. 27, T. 35 N., R. 15 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; very friable; common roots; neutral; abrupt smooth boundary.

A2—10 to 13 inches; brown (10YR 5/3) fine sandy loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak thick platy structure parting to weak fine subangular blocky; very friable; few roots; slightly acid; clear wavy boundary.

B&A—13 to 18 inches; dark brown (7.5YR 4/4) fine sandy loam (Bt); common coarse prominent strong brown (7.5YR 5/8) and common fine distinct grayish brown (10YR 5/2) mottles; weak medium and fine subangular blocky structure; friable; thin patchy clay films; brown (10YR 5/3) fine sandy loam tongues (A2) make up about 35 percent of the horizon; few roots; strongly acid; clear wavy boundary.

B2t—18 to 23 inches; dark brown (7.5YR 4/4) fine sandy loam; common medium prominent strong brown (7.5YR 5/8) and common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few roots; thin patchy clay films on faces of most peds; about 5 percent of the horizon occurs as tongues of brown (10YR 5/3) A2 material coating vertical faces of peds; strongly acid; clear wavy boundary.

B3t—23 to 32 inches; dark brown (7.5YR 4/4) fine sandy loam; common fine prominent strong brown (7.5YR 5/8) and common fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; very friable; few roots; thin patchy clay films on faces of peds; thin continuous clay films in root channels; medium acid; clear wavy boundary.

C—32 to 60 inches; strong brown (7.5YR 5/6) stratified silt, loamy fine sand, and fine sand; many medium prominent pinkish gray (7.5YR 6/2) mottles; massive; friable; slightly acid.

The solum ranges from 24 to 40 inches in thickness. Below the part that is influenced by agricultural lime, it ranges from very strongly acid to slightly acid. The control section has few to many low and high chroma mottles.

The Ap horizon is 6 to 10 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon, which is 1 inch to 5 inches thick. Some have an A&B horizon. The A2 horizon and the A2 part of the A&B and B&A horizons have color value of 4 to 6 and chroma of 2 or 3. They are dominantly silt loam, very fine sandy loam, or fine sandy loam but in some pedons are sandy loam or loamy fine sand.

The B2t and B3t horizons and the Bt part of the A&B and B&A horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 or 5. They are dominantly sandy loam or fine sandy loam, but in some pedons they have thin strata of silt loam, very fine sandy loam, or loamy fine sand.

The C horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It ranges from medium acid to neutral. It has thin strata of loam, sandy loam, loamy sand, or sand in some pedons.

Poskin series

The Poskin series consists of deep, somewhat poorly drained soils that are moderately permeable in the upper part and very rapidly permeable in the underlying material. These soils are on outwash plains and stream terraces. They formed in silty material and in the underlying glacial outwash. Slope ranges from 0 to 3 percent.

Poskin soils are similar to Dakota Variant soils and are commonly adjacent to Antigo, Brill, and Rosholt soils on the landscape. Dakota Variant soils have a mollic epipedon. The well drained Antigo and Rosholt soils and the moderately well drained Brill soils are slightly higher on the landscape than Poskin soils.

Typical pedon of Poskin silt loam, 0 to 3 percent slopes, 180 feet west and 2,568 feet north of the southeast corner of sec. 33, T. 34 N., R. 16 W.

Ap—0 to 8 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—8 to 12 inches; pale brown (10YR 6/3) silt; common fine prominent strong brown (7.5YR 5/6) mottles; moderate thin platy structure; very friable; few roots; medium acid; clear wavy boundary.

B&A—12 to 22 inches; yellowish brown (10YR 5/4) silt loam (Bt); many fine distinct strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; moderate medium and fine subangular blocky structure; friable; thin patchy clay films on faces of some peds; about 35 percent of the horizon occurs as tongues of pale brown (10YR 6/3) silt (A2); moderate thin platy structure; very friable; few fine dark reddish brown (5YR 2/2) manganese stains; few roots; very strongly acid; clear wavy boundary.

B21t—22 to 31 inches; yellowish brown (10YR 5/4) silt loam; many fine distinct strong brown (7.5YR 5/6) and grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; friable; pale brown (10YR 6/3) coatings on some primary vertical cleavage planes; thin patchy clay films on faces of most peds; few fine dark reddish brown (5YR 2/2) manganese stains; few roots; very strongly acid; clear wavy boundary.

B22t—31 to 37 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct grayish brown (2.5Y 5/2) and common coarse distinct strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; friable; few fine dark reddish brown (5YR 2/2) manganese stains; thin patchy clay films on faces of most peds; pale brown (10YR 6/3) coatings on some primary vertical cleavage planes; few roots; strongly acid; abrupt wavy boundary.

IIB3—37 to 39 inches; strong brown (7.5YR 5/6) sandy loam; many fine faint brownish yellow (10YR 6/6), many fine distinct reddish yellow (5YR 6/8), and many fine prominent grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; very friable; estimated 2 to 5 percent gravel; medium acid; clear wavy boundary.

IIC—39 to 60 inches; brown (7.5YR 5/4) sand and gravel; common medium distinct strong brown (7.5YR 5/6) mottles; single grained; loose; estimated 15 percent gravel; slightly acid.

The solum ranges from 24 to 40 inches in thickness and the depth to glacial outwash from 20 to 38 inches. The content of coarse fragments ranges, by volume, from 2 to 20 percent in the IIB3 horizon and from 10 to 40 percent in the IIC horizon. The part of the solum that is not influenced by agricultural lime ranges from very strongly acid to slightly acid.

The Ap horizon is 6 to 10 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon. The A2 horizon and the A2 part of the B&A horizon have color value of 4 to 6 and chroma of 2 or 3. They are silt loam or silt. The Bt horizon and the Bt part of the B&A horizon have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. They are silt loam or silty clay loam. The IIB3 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, sandy loam, or gravelly sandy loam. The IIC horizon is stratified sand and gravel or gravelly sand. It is medium acid or slightly acid.

Rifle series

The Rifle series consists of deep, very poorly drained, moderately rapidly permeable, organic soils in bogs in depressional areas on outwash plains, glacial lake basins, and glacial moraines. These soils formed in organic material derived from herbaceous plants. Slope ranges from 0 to 2 percent.

Rifle soils are similar to Seelyeville soils and are commonly adjacent to Cathro, Markey, and Seelyeville soils on the landscape. Cathro and Markey soils have a IIC horizon at a depth of 16 to 51 inches. Seelyeville soils contain more sapric material in the control section than Rifle soils.

Typical pedon of Rifle muck, 2,040 feet north and 30 feet west of the southeast corner of sec. 24, T. 36 N., R. 18 W.

Oa1—0 to 3 inches; dark reddish brown (5YR 2/2) broken face, black (N 2/0) rubbed, sapric material; about 10 percent fiber, 2 percent rubbed; weak fine subangular blocky structure; nonsticky; primarily herbaceous fibers; neutral; clear wavy boundary.

Oa2—3 to 9 inches; dark reddish brown (5YR 2/2) broken face, black (N 2/0) rubbed, sapric material; about 15 percent fiber, 4 percent rubbed; weak medium and fine subangular blocky structure; slightly sticky; primarily herbaceous fibers; slightly acid; clear wavy boundary.

Oe1—9 to 17 inches; dark brown (10YR 3/3) broken face, very dark grayish brown (10YR 3/2) rubbed, hemic material; about 65 percent fiber, 15 percent rubbed; moderate coarse subangular blocky structure; nonsticky; primarily herbaceous fibers; medium acid; clear wavy boundary.

Oe2—17 to 45 inches; dark brown (7.5YR 3/2) broken face and rubbed hemic material; about 75 percent fiber, 35 percent rubbed; weak thick platy structure; nonsticky; sodium pyrophosphate very pale brown (10YR 7/3); medium acid; clear wavy boundary.

Oa3—45 to 60 inches; black (5Y 2/2) broken face and rubbed sapric material; about 15 percent fiber, 6 percent rubbed; massive; slightly sticky; sodium pyrophosphate very pale brown (10YR 7/4); slightly acid.

The organic material is 51 or more inches thick. The fibers are derived mostly from herbaceous plants, but some layers contain moss fibers. Some pedons contain woody fragments, but this material is less than 15 percent of the volume.

The surface tier is dominantly sapric material. It has hue of 10YR, 7.5YR, or 5YR; value of 2 to 4; and chroma of 1 to 4. The control section is dominantly hemic material, but some pedons have layers of sapric or fibric material totaling less than 10 inches thick. The subsurface and bottom tiers have hue of 10YR, 7.5YR, or 5YR and value and chroma of 2 to 4. Reaction ranges from medium acid to neutral.

Rosholt series

The Rosholt series consists of deep, well drained soils that are moderately permeable in the upper part and very rapidly permeable in the underlying material. These soils are on glacial outwash plains and stream terraces. They formed in loamy sediments and in the underlying sand and gravel glacial outwash (fig. 13). Slope ranges from 0 to 30 percent.

Rosholt soils are similar to Dakota soils and are commonly adjacent to Chetek, Cromwell, and Cromwell Variant soils on the landscape. Dakota soils contain more clay in the control section than Rosholt soils and have a mollic epipedon. The somewhat excessively drained Chetek and Cromwell soils have a thinner solum than Rosholt soils. The somewhat poorly drained Cromwell Variant soils are slightly lower on the landscape than Rosholt soils.

Typical pedon of Rosholt loam, 0 to 2 percent slopes, 250 feet north and 1,480 feet east of the southwest corner of sec. 29, T. 34 N., R. 15 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam; moderate fine subangular blocky structure parting to moderate medium granular; friable; estimated 3 percent gravel; many roots; slightly acid; abrupt smooth boundary.

A2—7 to 14 inches; brown (10YR 5/3) loam; moderate medium platy structure; friable; estimated 3 percent gravel; many roots; slightly acid; clear wavy boundary.

A&B—14 to 19 inches; brown (10YR 5/3) loam (A2); weak thick platy structure; friable; about 55 percent of the horizon occurs as tongues, 10 to 30 millimeters thick, extending into or completely surrounding isolated remnants of dark brown (7.5YR 4/4) loam (Bt); moderate medium subangular blocky structure; firm; thin patchy clay films on faces of some peds; estimated 5 percent gravel; many roots; medium acid; gradual wavy boundary.

B&A—19 to 26 inches; dark brown (7.5YR 4/4) loam (Bt), which makes up about 70 percent of the horizon; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of most peds (Bt); tongues of brown (10YR 5/3) sandy loam (A2) extend to bottom of horizon; weak thick platy structure; friable; estimated 5 percent gravel; many roots; medium acid; clear wavy boundary.

B2t—26 to 32 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; thin patchy clay films on most vertical faces of peds; many roots; medium acid; clear wavy boundary.

IIB3—32 to 37 inches; dark brown (7.5YR 4/4) loamy coarse sand; weak medium subangular blocky structure; very friable; estimated 12 percent gravel; many roots; medium acid; clear wavy boundary.

IIC1—37 to 48 inches; dark brown (7.5YR 4/4) stratified coarse sand and fine gravel; single grained; loose; few roots; medium acid; abrupt smooth boundary.

IIC2—48 to 60 inches; brown and strong brown (7.5YR 5/4 and 5/6) stratified coarse sand and fine gravel; single grained; loose; slightly acid.

The solum ranges from 24 to 40 inches in thickness and the depth to glacial outwash from 20 to 36 inches. The content of coarse fragments ranges from 0 to 15 percent in the upper part of the solum, from 10 to 40 percent in the IIB3t horizon, and from 15 to 50 percent in the IIC horizon. The content of cobbles ranges from 5 to 15 percent in the IIC horizon. The part of the solum that is not influenced by agricultural lime ranges from strongly acid to slightly acid.

The Ap horizon is 6 to 10 inches thick. It has color value of 3 or 4 and chroma of 2 or 3. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. The A2 horizon and the A2 part of the A&B and B&A horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. They are typically loam or sandy loam but in some pedons are loamy sand.

The B2t horizon and the Bt part of the A&B and B&A horizons have hue of 7.5YR or 5YR and value and chroma of 3 to 5. They are sandy loam or loam. The IIB3 horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 3 to 6. It is loamy coarse sand, loamy sand, sandy loam, gravelly loamy sand, or gravelly sandy loam.

The IIC horizon is stratified coarse sand and fine gravel or gravelly coarse sand. It ranges from strongly acid to slightly acid.

Rosholt Variant

The Rosholt Variant consists of moderately deep, well drained, moderately permeable soils on bedrock-controlled uplands. These soils formed in silty sediments and in residuum weathered from dolomitic limestone bedrock. Slope ranges from 2 to 6 percent.

Rosholt Variant soils are commonly adjacent to Antigo, Dakota, and other Rosholt soils on the landscape. None of these adjacent soils has bedrock within a depth of 40 inches.

Typical pedon of Rosholt Variant silt loam, 2 to 6 percent slopes, 45 feet south and 450 feet east of the northwest corner of sec. 11, T. 32 N., R. 18 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; friable; few roots; mildly alkaline; abrupt smooth boundary.

A2—10 to 11 inches; light brownish gray (10YR 6/2) silt; moderate thin platy structure; friable; few roots; mildly alkaline; abrupt smooth boundary.

B&A—11 to 19 inches; dark yellowish brown (10YR 4/4) silt loam (Bt); moderate fine subangular blocky structure; friable; thin patchy clay films (Bt); tongues of light brownish gray (10YR 6/2) silt (A2) make up about 35 percent of the horizon; moderate thin platy structure; few roots; mildly alkaline; abrupt wavy boundary.

IIB21t—19 to 22 inches; dark brown (7.5YR 4/4) loam; moderate medium and fine subangular blocky structure; firm; few roots; moderately thick dark reddish brown (5YR 2/2) patchy clay films; moderately alkaline; abrupt wavy boundary.

IIB22t—22 to 23 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few roots; moderately thick dark reddish brown (5YR 2/2) patchy clay films; moderately alkaline; abrupt smooth boundary.

R—23 inches; light yellowish brown (2.5Y 6/4) dolomitic limestone bedrock.

The solum is dominantly 20 to 30 inches thick but ranges from 20 to 40 inches. It ranges from slightly acid to moderately alkaline. Typically, it contains no coarse fragments. In some pedons, however, the content of these fragments is, by volume, as much as 10 percent in the lower part of the solum.

The Ap horizon is 5 to 10 inches thick. It has color value of 2 to 4 and chroma of 2 or 3. Some pedons have an A1 horizon, which is 1 inch to 4 inches thick. Some have an A&B horizon. The A2 horizon and the A2 part of the B&A and A&B horizons have color value of 4 to 6 and chroma of 2 or 3. They are silt loam or silt. In some pedons plowing has mixed the A2 horizon with the Ap horizon.

Some pedons have a B2t horizon. The Bt part of the B&A and A&B horizons and the B2t horizon have hue of 10YR or 7.5YR and value and chroma of 4 or 5. They are typically silt loam but are loam in some pedons. The IIB2t horizon has hue of 7.5YR or 5YR and value and chroma of 3 to 5. It is loam, clay loam, or silty clay loam.

Santiago series

The Santiago series consists of deep, well drained, moderately permeable or moderately slowly permeable soils on glacial uplands. These soils formed in silty sediments and in the underlying sandy loam glacial till (fig. 14). Slope ranges from 1 to 20 percent.

Santiago soils are similar to Amery and Cushing soils and are commonly adjacent to Amery, Auburndale, Freeon, and Magnor soils on the landscape. Amery soils contain less clay in the control section than Santiago soils. Cushing soils are less acid than Santiago soils and are underlain by loam glacial till. The poorly drained Auburndale, moderately well drained Freeon, and somewhat poorly drained Magnor soils are lower on the landscape than Santiago soils and are less sloping.

Typical pedon of Santiago silt loam, 1 to 6 percent slopes, 210 feet east and 1,210 feet south of the northwest corner of sec. 15, T. 32 N., R. 16 W.

O1—1 inch to 0; dark brown (7.5YR 3/2) partly decomposed litter.

A1—0 to 3 inches; very dark brown (10YR 2/2) silt loam; weak fine subangular blocky structure; friable; many roots; slightly acid; abrupt wavy boundary.

A2—3 to 12 inches; brown (10YR 5/3) silt loam; weak thin platy structure parting to weak very fine subangular blocky; very friable; common roots; medium acid; clear wavy boundary.

B&A—12 to 18 inches; yellowish brown (10YR 5/4) silt loam (Bt); moderate fine subangular blocky structure; friable; thin patchy clay films on faces of some peds; tongues of brown (10YR 5/3) silt loam (A2) make up about 30 percent of the horizon; weak very fine subangular blocky structure; very friable; common roots; strongly acid; clear wavy boundary.

B21t—18 to 24 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; thin patchy clay films on faces of some peds; coatings of brown (10YR 5/3) A2 material on some vertical faces of peds; estimated 1 percent gravel; common roots; strongly acid; clear wavy boundary.

IIB22t—24 to 28 inches; brown (7.5YR 5/4) loam; moderate medium subangular blocky structure; firm; moderately thick dark brown (7.5YR 4/4) clay films on faces of peds; estimated 9 percent gravel; strongly acid; clear wavy boundary.

IIB3t—28 to 38 inches; brown (7.5YR 5/4) sandy loam; moderate medium subangular blocky structure; firm; thin patchy dark brown (7.5YR 4/4) clay films on faces of some peds; few black (N 2/0) manganese stains; estimated 10 percent gravel; strongly acid; clear wavy boundary.

IIC—38 to 60 inches; reddish brown (5YR 4/4) sandy loam; massive; firm; estimated 10 percent gravel; slightly acid.

The solum ranges from 24 to 40 inches in thickness and the depth to glacial till from 15 to 30 inches. The IIB and IIC horizons range, by volume, from 8 to 20 percent coarse fragments. They have a bulk density of more than 1.7 grams per cubic centimeter. The part of the solum that is not influenced by agricultural lime ranges from very strongly acid to slightly acid.

The A1 horizon is 1 inch to 4 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an Ap horizon, which is 6 to 10 inches thick. Some have an A&B horizon. The A2 horizon and the A2 part of the B&A and A&B horizons have color value of 4 to 6 and chroma of 2 or 3. They are silt loam or silt.

The B2t horizon and the Bt part of the B&A and A&B horizons have hue of 7.5YR or 10YR and value and chroma of 4 or 5. The IIB2t horizon has hue of 5YR or 7.5YR and value and chroma of 3 to 5. It is typically loam or sandy loam but in some pedons is fine sandy loam. Some pedons do not have a IIB3 horizon.

The IIC horizon has hue of 2.5YR or 5YR and value and chroma of 3 to 5. It is typically sandy loam but is loamy sand or loam in some pedons. It is medium acid or slightly acid.

Seelyeville series

The Seelyeville series consists of deep, very poorly drained, moderately rapidly permeable, organic soils in depressional areas on outwash plains, glacial lake basins, and glacial moraines. These soils formed in organic material derived from herbaceous plants. Slope ranges from 0 to 2 percent.

Seelyeville soils are similar to Rifle soils and are commonly adjacent to Cathro, Markey, and Rifle soils on the landscape. Cathro and Markey soils have a IIC horizon at a depth of 16 to 51 inches. Rifle soils have a higher content of hemic material in the control section than Seelyeville soils.

Typical pedon of Seelyeville muck, 1,340 feet north and 380 feet west of the southeast corner of sec. 9, T. 36 N., R. 18 W.

Oi1—0 to 1 inch; pale brown (10YR 6/3) broken face and rubbed fibric material; about 95 percent sphagnum moss rubbed; massive; nonsticky; slightly acid; abrupt wavy boundary.

Oa1—1 inch to 6 inches; very dark brown (10YR 2/2) broken face and rubbed sapric material; about 15 percent fiber, 5 percent rubbed; weak medium subangular blocky structure; slightly sticky; primarily herbaceous fibers; medium acid; clear wavy boundary.

Oe1—6 to 14 inches; dark brown (7.5YR 4/2) broken face, dark brown (7.5YR 3/2) rubbed, hemic material; about 30 percent fiber, 18 percent rubbed; weak coarse subangular blocky structure; nonsticky; primarily herbaceous fibers; sodium pyrophosphate light yellowish brown (10YR 6/4); medium acid; abrupt wavy boundary.

Oa2—14 to 58 inches; dark brown (7.5YR 3/2) broken face and rubbed sapric material; about 19 percent fiber, 10 percent rubbed; massive; nonsticky; primarily herbaceous fibers; sodium pyrophosphate yellowish brown (10YR 5/4); medium acid; clear wavy boundary.

Oa3—58 to 60 inches; strong brown (7.5YR 5/6) broken face, dark brown (7.5YR 3/2) rubbed, sapric material; about 60 percent fiber, 12 percent rubbed; weak thin platy structure; nonsticky; primarily herbaceous (moss) fibers; medium acid.

The organic material is 51 or more inches thick. The fibers are derived mostly from herbaceous plants, but some layers contain moss fibers. The soils typically contain no woody fragments, but in some pedons a small amount is in the surface tier.

Some pedons have a fibric layer of moss fibers at the surface, but this layer is less than 6 inches thick. The control section is medium acid to neutral. It ranges from 10 to 25 percent mineral material. It is primarily sapric material, but in some pedons the subsurface and bottom tiers have layers of hemic material totaling less than 10 inches thick. The sapric material has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2, broken face and rubbed.

Warman Variant

The Warman Variant consists of deep, poorly drained and very poorly drained soils that are moderately rapidly permeable in the upper part and very rapidly permeable in the underlying material. These soils are on glacial outwash plains and stream terraces. They formed in loamy sediments and in the underlying sand and gravel glacial outwash. Slope ranges from 0 to 2 percent.

Warman Variant soils are commonly adjacent to Brill, Cromwell Variant, and Poskin soils. The moderately well drained Brill and somewhat poorly drained Poskin soils contain more silt in the control section than Warman Variant soils and are slightly higher on the landscape. The somewhat poorly drained Cromwell Variant soils also are slightly higher on the landscape.

Typical pedon of Warman Variant sandy loam, 200 feet west and 2,020 feet north of the southeast corner of sec. 10, T. 36 N., R. 18 W.

O1—1 inch to 0; dark brown (10YR 3/3) and dark yellowish brown (10YR 4/4) partly decomposed litter; medium acid; abrupt smooth boundary.

A1—0 to 6 inches; very dark gray (10YR 3/1) sandy loam; weak medium and fine subangular blocky structure; friable; common roots; medium acid; clear wavy boundary.

A3—6 to 9 inches; very dark gray (10YR 3/1) sandy loam; common fine prominent strong brown (7.5YR 5/6) and few medium distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; friable; estimated 5 percent gravel; common roots; strongly acid; clear wavy boundary.

Bg—9 to 19 inches; gray (10YR 6/1) sandy loam; common fine prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; estimated 5 percent gravel; few roots; medium acid; clear wavy boundary.

IIB3—19 to 28 inches; strong brown (7.5YR 5/6) gravelly loamy sand; few coarse distinct reddish yellow (7.5YR 7/6) and few coarse prominent pinkish gray (7.5YR 6/2) mottles; weak coarse subangular blocky structure; very friable; estimated 16 percent gravel; slightly acid; clear wavy boundary.

IIC—28 to 60 inches; brown (7.5YR 5/4) stratified coarse sand and gravel; single grained; loose; slightly acid.

The solum ranges from 24 to 40 inches in thickness and the depth to glacial outwash from 15 to 30 inches. The content of coarse fragments ranges from 0 to 10 percent in the upper part of the solum and from 10 to 50 percent in the IIB and IIC horizons. In most pedons the solum has faint to prominent mottles. Below the part that is influenced by agricultural lime, it ranges from strongly acid to slightly acid.

The A1 horizon is 5 to 9 inches thick. It has color value of 2 or 3 and chroma of 1 or 2. Some pedons have an Ap horizon. The Bg horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1. It is dominantly sandy loam or fine sandy loam, but some pedons have subhorizons of loam or sandy clay loam. The IIB3 horizon has hue of 10YR, 7.5YR, or 5YR and value and chroma of 4 to 6. It is loamy sand, sandy loam, gravelly loamy sand, or gravelly sandy loam. The IIC horizon is stratified sand or coarse sand and gravel or gravelly or very gravelly coarse sand. It is medium acid or slightly acid.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*8*).

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

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

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is 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 expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Glossoboralfs (*Gloss*, meaning tongued, plus *boralf*, the suborder of Alfisols that have an albic horizon tonguing into an argillic horizon).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Glossoboralfs.

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

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

Formation of the soils

The paragraphs that follow enumerate the factors of soil formation and explain the processes of soil formation. The factors of soil formation are parent material, climate, vegetation, relief, and time, all of which affect the genesis of soils. The processes of soil formation, which differentiate soil horizons, are accumulation of organic matter in the surface layer, leaching of carbonates and exchangeable bases from the solum, movement of silicate clays and associated sesquioxides from the A horizon and their accumulation in the B horizon, and partial destruction or degradation of the upper part of the illuvial B horizon.

Santiago soils illustrate how the processes and factors of soil formation interact. These soils formed in silty sediment, or loess, over loamy glacial till. They are affected by both a cool, humid to subhumid climate and a mixed deciduous and coniferous forest cover. The parent material, climate, and vegetation are conditioned by a nearly level to hilly, complex relief. The extent of the combined influence of these four factors is determined by the amount of time that the factors have influenced soil formation, which in Santiago soils is probably about 11,000 years.

The genesis and morphology of Santiago soils are expressed generally in prominent horizons within the solum (*3*.) In these soils a thin, dark colored A1 horizon overlies a leached, light colored, platy A2 horizon that tongues into an underlying blocky B horizon in which clay and sesquioxide have accumulated.

Organic matter has accumulated in the thin A1 horizon. Much of the organic matter is humus. In forested areas fresh or partly decomposed leaf litter is at the surface. Organic acids produced during the decomposition of this litter probably contribute to the reduction and solubility of iron and aluminum. They are subsequently leached in the profile. The result apparently is a lower base status and an acid solum. The base saturation in these soils is less, in many areas much less, than 60 percent in some part of the argillic horizon.

Indirectly, leaching also permits translocation of silicate clay minerals, organic matter, and sesquioxides from eluvial, or A2, horizons to related illuvial, or Bt, horizons. Apparently, the mineral species separate and move mechanically or in the chemically altered form of clay minerals from the zone of eluviation. The result is a substantial loss of clay and other material from the A2 horizon. The bleached color of this horizon is primarily the color of the mineral separates that remain after clay and organic matter have been removed.

The translocated material carried into the B horizon is part of an illuvial concentration of silicate clay, iron, aluminum, and humus, generally in combination, in the Bt, or argillic, horizon. This illuvial B horizon, including the part formed in the loess and that formed in till, has a higher content of clay and possibly of fine clay than either the A2 horizon above or the C horizon below. Clay films occur as thin or moderately thick, patchy layers on faces of blocky structural peds in the B horizon. In areas of maximum accumulation, the translocated clay enters the natural cracks in the soil and extends into crevasses and openings left by plant roots, worms, and insects.

In Santiago soils, horizons of silicate clay accumulation formed and later were partly destroyed. In the initial phase of the degradation or destruction of the B horizon, clay films are stripped from the primary ped faces in the upper part, leaving uncoated silt or sand grains. Water moving along vertical and, to a lesser extent, horizontal cleavage planes flushes the altered or unaltered clay from the ped faces, leaving behind skeletal frameworks of uncoated silt and sand. This destruction results ultimately in an intermingling of A2 and B horizons. The degradation commonly is manifest in tongues of uncoated silt and sand 5 to 15 millimeters or more thick. These tongues extend into or through the B horizon.

All of these processes are active in many of the soils of the survey area. The kind of parent material and the relief have, to a great extent, determined the kinds of soil-forming processes that are dominant and have caused morphological differences among the soils.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering

purposes. ASTM Stand. D-2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.
(3) Carroll, Paul H. 1964. Santiago soils: a summary of pertinent data for use in classification and interpretation. 68 pp., illus.
(4) Curtis, John T. 1959. The vegetation of Wisconsin: an ordination of plant communities. 657 pp., illus. [Second printing 1971.]
(5) Shaw, Samuel P., and C. Gordon Fredine. 1956. Wetlands of the United States. U.S. Dep. Inter., Fish and Wildl. Serv. Circ. 39, 67 pp., illus.
(6) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962.]
(7) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.
(8) United States Department of Agriculture. 1975. Soil taxonomy: a basic system of soil classification for making and interpreting soil surveys. U.S. Dep. Agric. Handb. 436, 754 pp., illus.
(9) Wisconsin Department of Business Development. [n.d.] Economic profile of Polk County. 6 pp., illus.
(10) Wisconsin Department of Natural Resources. [n.d.] Wisconsin forest resource statistics west central survey report. Bull., illus.
(11) Young, H. L., and S. M. Hindall. 1973. Water resources of Wisconsin St. Croix River Basin. U.S. Geol. Surv. Hydrol. Invest. Atlas HA-451, 4 pp., illus.

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

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 with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earth-moving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects 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 for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

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. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes by water originating mainly from the melting of glacial ice. Many are interbedded or laminated.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

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 from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse* more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material mixed with mineral soil material. The content of organic matter is more than 20 percent.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the basis of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes in this survey area are *nearly level,* 0 to 2 percent, *gently sloping or undulating,* 2 to 6 percent, *sloping or rolling,* 6 to 12 percent, *moderately steep or hilly,* 12 to 20 percent, *steep or very hilly,* 20 to 30 percent, and *very steep,* more than 30 percent. These slope classes are represented by the letters A, B, C, D, E, and F, respectively.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *pris-*

matic (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. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

ILLUSTRATIONS

Figure 1.—Harvesting jack pine pulpwood in an area of Omega soils.

Figure 2.—Typical area of the Amery-Santiago-Magnor map unit. Contour stripcropping and terracing are not feasible on these short, uneven slopes.

Figure 3.—Typical area of the Antigo-Rosholt map unit, on broad outwash plains. These soils are suited to cultivated crops.

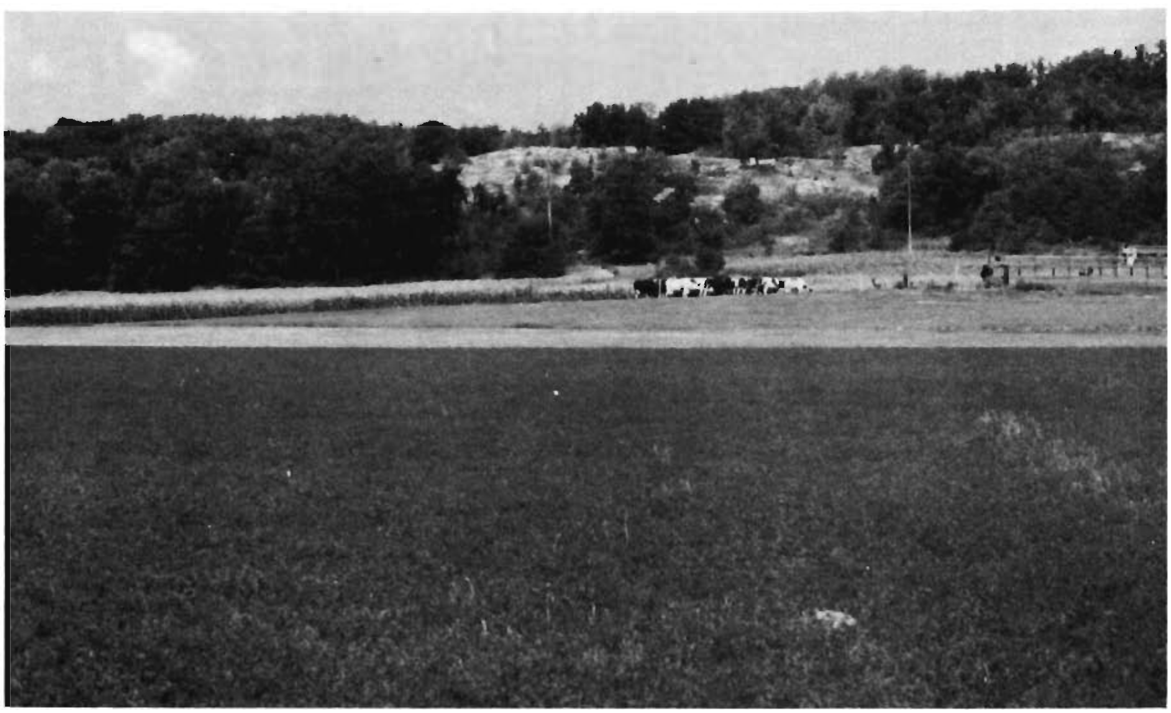


Figure 4.—Typical area of the Burkhardt-Dakota map unit. Amery-Rock outcrop complex, 12 to 45 percent slopes, is on the ridge in the background.

Figure 5.—Typical area of the Rosholt-Cromwell-Menahga map unit.

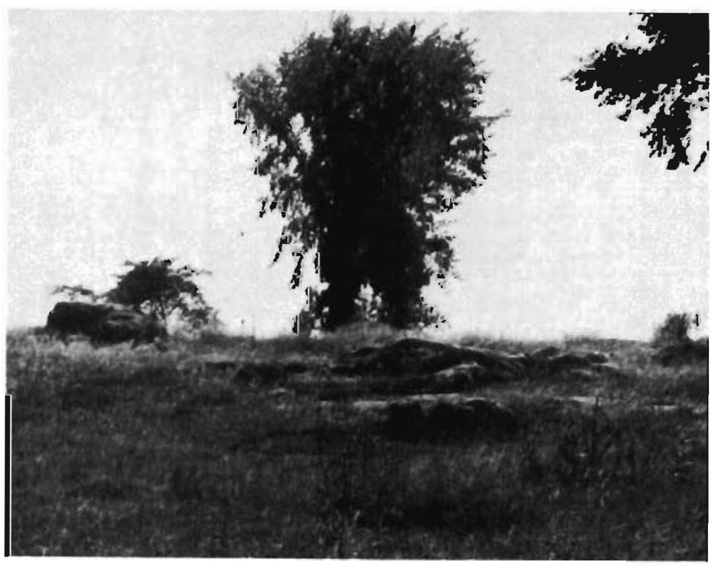


Figure 6.—Pastured area of Amery-Rock outcrop complex, 2 to 12 percent slopes. The outcrop is igneous rock locally known as traprock.

Figure 7.—Typical area of Amery-Rock outcrop complex, 12 to 45 percent slopes, which generally is unsuited to cultivated crops, pasture, woodland, and most engineering uses.

Figure 8.—Red pine planted on the contour in an area of Chetek sandy loam, 12 to 20 percent slopes, eroded.

Figure 9.—An area of Pits, gravel.

Figure 10.—Typical vegetation of cattail, marsh grasses, and duckweed in an area of Saprists and Aquents.

Figure 11.—Typical vegetation of cattail, leatherleaf, and tamarack in an area of Seelyeville muck.

Figure 12.—Road damage caused by frost heaving in an area of Magnor silt loam.

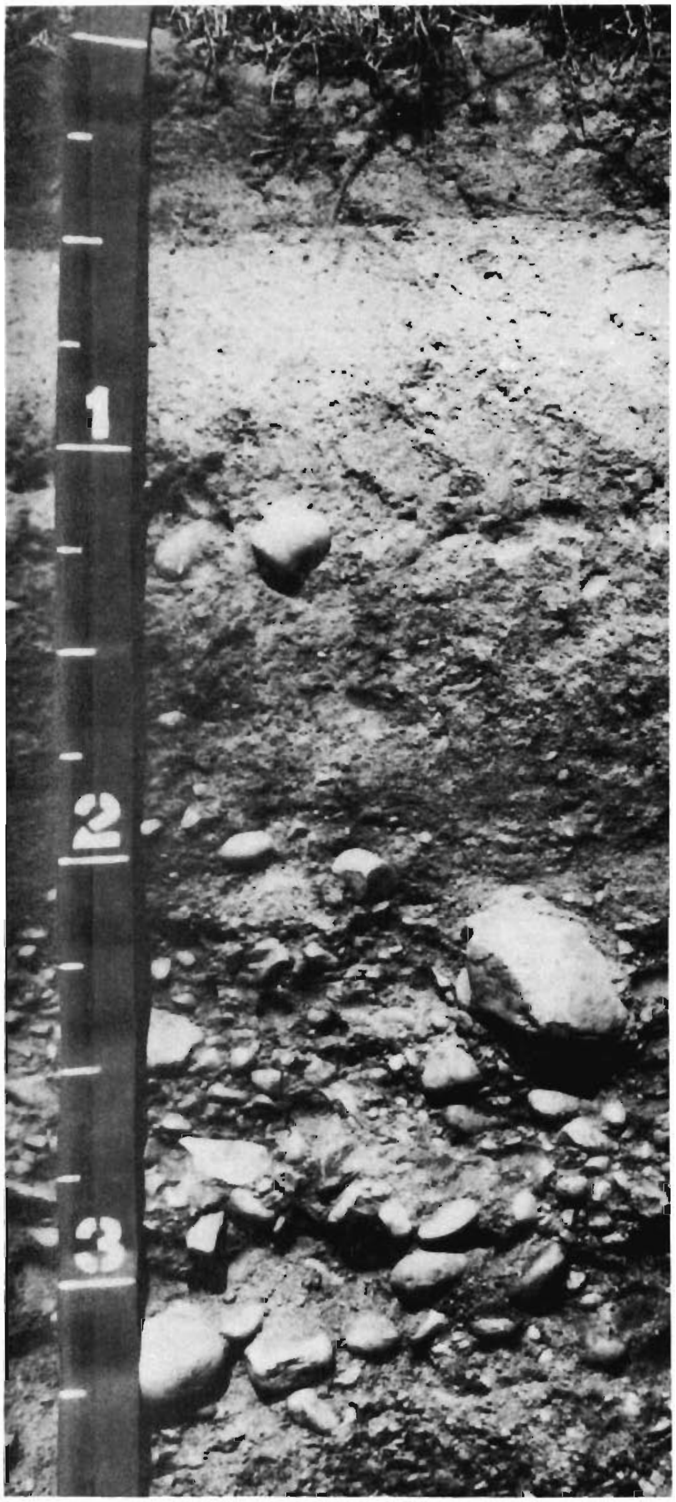


Figure 13.—Profile of Rosholt loam, which formed in loamy sediments and in the underlying sand and gravel glacial outwash. Depth is indicated in feet.

Figure 14.—Profile of Santiago silt loam, which formed in silty sediments and in the underlying sandy loam glacial till. Depth is indicated in feet.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[All data from Amery, Wisconsin, based on records from 1930 through 1959]

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: 2 years in 10 will have monthly average: Temperature equal to or higher than--	Temperature: 2 years in 10 will have monthly average: Temperature equal to or lower than--	Precipitation: Average monthly total	Precipitation: 2 years in 10 will have--: Less than--	Precipitation: 2 years 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---	22.0	1.7	18.1	6.4	0.74	0.29	1.10	2	8.1
February--	25.7	4.1	19.0	11.5	0.79	0.21	1.24	2	8.4
March-----	36.5	16.6	29.9	22.6	1.34	0.46	2.18	4	9.0
April-----	54.5	32.6	47.1	39.8	2.12	1.23	3.09	6	1.8
May-------	68.3	44.1	60.3	53.5	3.50	2.04	5.35	7	0.2
June------	77.0	54.2	68.0	63.1	4.82	2.64	7.19	8	0.0
July------	82.9	59.0	73.2	68.3	3.40	1.76	4.47	7	0.0
August----	80.7	56.7	71.2	66.3	3.76	2.34	4.89	6	0.0
September-	70.6	48.5	61.5	56.8	2.94	0.97	4.70	5	(*)
October---	59.2	37.6	51.0	44.0	1.92	0.60	2.90	4	0.8
November--	39.4	22.6	35.8	26.9	1.52	0.70	2.05	4	5.2
December--	26.2	9.8	22.0	13.4	0.80	0.28	1.28	3	7.7
Year---	53.6	32.3	---	---	27.65	23.22	30.08	58	41.2

* Trace.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[All data from Amery, Wisconsin, based on records from 1930 through 1959]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
2 years in 10 later than--	Apr. 8	Apr. 19	May 4	May 15	May 25
4 years in 10 later than--	Mar. 31	Apr. 11	Apr. 27	May 7	May 18
6 years in 10 later than--	Mar. 25	Apr. 5	Apr. 20	May 1	May 12
8 years in 10 later than--	Mar. 17	Mar. 28	Apr. 12	Apr. 23	May 5
Fall:					
2 years in 10 earlier than-	Oct. 29	Oct. 16	Oct. 6	Sept. 23	Sept. 8
4 years in 10 earlier than-	Nov. 6	Oct. 24	Oct. 14	Oct. 1	Sept. 16
6 years in 10 earlier than-	Nov. 12	Oct. 30	Oct. 21	Oct. 7	Sept. 22
8 years in 10 earlier than-	Nov. 20	Nov. 7	Oct. 28	Oct. 15	Sept. 29

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ad	Adolph silt loam	5,770	0.9
AfA	Alban fine sandy loam, 0 to 2 percent slopes	710	0.1
AfB	Alban fine sandy loam, 2 to 6 percent slopes	3,480	0.6
AfC2	Alban fine sandy loam, 6 to 12 percent slopes, eroded	1,820	0.3
AfD	Alban fine sandy loam, 12 to 20 percent slopes	500	0.1
Ag	Alstad loam, 0 to 3 percent slopes	800	0.1
AlB	Amery sandy loam, 1 to 6 percent slopes	7,240	1.2
AlC	Amery sandy loam, 6 to 12 percent slopes	21,240	3.4
AlD	Amery sandy loam, 12 to 20 percent slopes	13,700	2.2
AlE	Amery sandy loam, 20 to 30 percent slopes	1,590	0.3
AnB	Amery silt loam, 1 to 6 percent slopes	5,530	0.9
AnC	Amery silt loam, 6 to 12 percent slopes	9,480	1.5
AoB	Amery complex, 1 to 6 percent slopes	3,200	0.5
AoC	Amery complex, 6 to 12 percent slopes	22,870	3.7
AoD	Amery complex, 12 to 20 percent slopes	36,100	5.9
AoE	Amery complex, 20 to 30 percent slopes	4,000	0.6
ArC	Amery-Rock outcrop complex, 2 to 12 percent slopes	820	0.1
ArD	Amery-Rock outcrop complex, 12 to 45 percent slopes	2,600	0.4
AtA	Antigo silt loam, 0 to 2 percent slopes	15,270	2.5
AtB	Antigo silt loam, 2 to 6 percent slopes	46,950	7.7
AtC2	Antigo silt loam, 6 to 12 percent slopes, eroded	6,330	1.0
AuA	Auburndale silt loam, 0 to 3 percent slopes	3,420	0.6
Ba	Barronett silt loam	2,560	0.4
Be	Barronett Variant fine sandy loam	1,880	0.3
Bf	Bluffton loam	1,050	0.2
BlA	Brill silt loam, 0 to 3 percent slopes	1,630	0.3
BpA	Burkhardt sandy loam, 0 to 2 percent slopes	1,370	0.2
BpB	Burkhardt sandy loam, 2 to 6 percent slopes	5,070	0.8
BpC2	Burkhardt sandy loam, 6 to 12 percent slopes, eroded	920	0.1
CaA	Campia silt loam, 0 to 2 percent slopes	870	0.1
CaB	Campia silt loam, 2 to 6 percent slopes	1,650	0.3
CaC2	Campia silt loam, 6 to 12 percent slopes, eroded	360	0.1
CbB	Campia Variant loam, 2 to 6 percent slopes	1,070	0.2
CbC	Campia Variant loam, 6 to 12 percent slopes	400	0.1
CbD	Campia Variant loam, 12 to 20 percent slopes	310	0.1
Cc	Cathro muck	4,000	0.6
ChB	Chetek sandy loam, 2 to 6 percent slopes	1,510	0.2
ChC2	Chetek sandy loam, 6 to 12 percent slopes, eroded	3,810	0.6
ChD2	Chetek sandy loam, 12 to 20 percent slopes, eroded	4,490	0.7
CmA	Comstock silt loam, 0 to 3 percent slopes	2,630	0.4
CpA	Comstock Variant loam, 0 to 3 percent slopes	360	0.1
CrA	Cromwell sandy loam, 0 to 2 percent slopes	680	0.1
CrB	Cromwell sandy loam, 2 to 6 percent slopes	5,470	0.9
CrC	Cromwell sandy loam, 6 to 12 percent slopes	6,730	1.1
CrD	Cromwell sandy loam, 12 to 25 percent slopes	7,700	1.2
CsA	Cromwell Variant sandy loam, 0 to 3 percent slopes	640	0.1
CtA	Croswell loamy sand, 0 to 3 percent slopes	2,410	0.4
CuA	Crystal Lake silt loam, 0 to 2 percent slopes	420	0.1
CuB	Crystal Lake silt loam, 2 to 6 percent slopes	470	0.1
CvB	Cushing loam, 2 to 6 percent slopes	4,460	0.7
CvC2	Cushing loam, 6 to 12 percent slopes, eroded	3,920	0.6
CvD	Cushing loam, 12 to 20 percent slopes	4,010	0.6
CvE	Cushing loam, 20 to 30 percent slopes	1,350	0.2
CwD3	Cushing soils, 12 to 25 percent slopes, severely eroded	810	0.1
CxB	Cushing complex, 2 to 6 percent slopes	830	0.1
CxC2	Cushing complex, 6 to 12 percent slopes, eroded	770	0.1
CxD2	Cushing complex, 12 to 20 percent slopes, eroded	1,130	0.2
DaA	Dakota loam, 0 to 2 percent slopes	750	0.1
DaB	Dakota loam, 2 to 6 percent slopes	700	0.1
DlA	Dakota loam, limestone substratum, 0 to 3 percent slopes	1,280	0.2
DvA	Dakota Variant silt loam, 0 to 3 percent slopes	1,030	0.2
EmD	Emmert gravelly sandy loam, 12 to 35 percent slopes	470	0.1
Fa	Fluvaquents	3,260	0.5
Fe	Fluvaquents, wet	7,990	1.3
FnB	Freeon silt loam, 2 to 6 percent slopes	10,940	1.8
HrB	Hubbard loamy sand, 0 to 6 percent slopes	2,450	0.4
LnA	Lino loamy fine sand, 0 to 3 percent slopes	780	0.1
MaA	Magnor silt loam, 0 to 2 percent slopes	3,530	0.6
MaB	Magnor silt loam, 2 to 6 percent slopes	19,920	3.2
Mk	Markey muck	1,600	0.3
MnB	Menahga loamy sand, 1 to 6 percent slopes	7,850	1.3
MnC	Menahga loamy sand, 6 to 12 percent slopes	5,330	0.9

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
MnD	Menahga loamy sand, 12 to 25 percent slopes	19,610	3.2
MoB	Mora loam, 1 to 4 percent slopes	4,480	0.7
Ns	Newson loamy fine sand	2,640	0.4
NyA	Nymore fine sand, 0 to 3 percent slopes	2,680	0.4
OgB	Omega fine sand, 2 to 6 percent slopes	8,510	1.4
OgC	Omega fine sand, 6 to 12 percent slopes	7,810	1.3
OgD	Omega fine sand, 12 to 20 percent slopes	2,860	0.5
Pg	Pits, gravel	420	0.1
PvA	Plover fine sandy loam, 0 to 3 percent slopes	1,600	0.3
PxA	Poskin silt loam, 0 to 3 percent slopes	3,240	0.5
Rf	Rifle muck	25,430	4.1
RoA	Rosholt loam, 0 to 2 percent slopes	1,410	0.2
RoB	Rosholt loam, 2 to 6 percent slopes	21,960	3.5
RoC2	Rosholt loam, 6 to 12 percent slopes, eroded	18,210	2.9
RoD	Rosholt loam, 12 to 20 percent slopes	5,210	0.8
RpB	Rosholt-Cromwell complex, 2 to 6 percent slopes	1,330	0.2
RpC	Rosholt-Cromwell complex, 6 to 12 percent slopes	10,030	1.6
RpD	Rosholt-Cromwell complex, 12 to 20 percent slopes	16,910	2.7
RpE	Rosholt-Cromwell complex, 20 to 30 percent slopes	2,540	0.4
RvB	Rosholt Variant silt loam, 2 to 6 percent slopes	260	(*)
SaB	Santiago silt loam, 1 to 6 percent slopes	29,880	4.9
SaC	Santiago silt loam, 6 to 12 percent slopes	12,820	2.1
SaD	Santiago silt loam, 12 to 20 percent slopes	1,060	0.2
ScB	Santiago-Antigo silt loams, 2 to 6 percent slopes	6,340	1.0
ScC	Santiago-Antigo silt loams, 6 to 12 percent slopes	3,290	0.5
ScD	Santiago-Antigo silt loams, 12 to 20 percent slopes	710	0.1
Se	Saprists and Aquents	3,960	0.6
Sm	Seelyeville muck	11,630	1.9
Us	Udorthents, sandy	5,360	0.9
Uy	Udorthents, loamy	2,540	0.4
Wv	Warman Variant sandy loam	2,070	0.3
	Water	23,680	3.8
	Total	619,520	100.0

* Less than 0.1 percent.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management. Only arable soils are listed. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Corn silage	Oats	Grass-legume hay	Kentucky bluegrass
	Bu	Ton	Bu	Ton	AUM*
Ad: Adolph	75	12	65	3.5	4.0
AfA: Alban	90	15	80	3.5	3.5
AfB: Alban	90	14	75	3.5	3.5
AfC2: Alban	80	12	70	3.0	3.2
AfD: Alban	70	10	60	2.5	2.7
Ag: Alstad	80	14	70	4.0	3.5
AlB: Amery	65	11	55	2.8	2.3
AlC: Amery	55	9	50	2.7	2.2
AlD: Amery	45	8	40	2.7	2.0
AlE: Amery	---	---	35	2.0	1.8
AnB: Amery	75	12	60	3.0	2.5
AnC: Amery	70	11	55	2.7	2.2
AoB: Amery	60	10	50	2.5	2.0
AoC: Amery	55	9	45	2.3	2.0
AoD: Amery	---	---	40	2.0	1.8
AoE: Amery	---	---	---	---	1.6
ArC: Amery-Rock outcrop	---	---	---	---	1.2
ArD: Amery-Rock outcrop	---	---	---	---	1.0
AtA: Antigo	85	15	80	3.5	3.5
AtB: Antigo	80	14	80	3.5	3.3
AtC2: Antigo	70	12	70	3.0	3.0
AuA: Auburndale	80	14	65	3.0	3.0
Ba: Barronett	70	12	70	3.0	3.0

See footnote at end of table.

TABLE 4.--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*
Be Barronett Variant	70	11	60	3.0	3.0
Bf Bluffton	75	10	60	4.0	3.5
BlA Brill	80	14	80	4.0	3.3
BpA Burkhardt	65	11	50	2.5	2.5
BpB Burkhardt	60	10	45	2.5	2.0
BpC2 Burkhardt	55	9	40	2.0	1.5
CaA Campia	90	14	80	4.0	3.5
CaB Campia	85	14	80	4.0	3.2
CaC2 Campia	80	13	70	3.5	3.0
CbB Campia Variant	85	14	75	4.0	3.2
CbC Campia Variant	80	12	70	3.5	3.0
CbD Campia Variant	70	12	65	3.0	2.8
Cc Cathro	---	15	---	3.5	---
ChB Chetek	60	10	50	2.5	2.3
ChC2 Chetek	55	9	45	2.5	2.2
ChD2 Chetek	---	---	40	1.5	2.0
CmA Comstock	80	13	70	3.5	3.5
CpA Comstock Variant	80	13	70	3.5	3.5
CrA Cromwell	50	10	40	2.5	2.0
CrB, CrC Cromwell	45	9	35	2.5	2.0
CrD Cromwell	---	---	---	3.0	1.2
CsA Cromwell Variant	70	12	55	2.5	2.5
CtA Croswell	---	---	40	2.5	---
CuA Crystal Lake	90	14	80	4.0	3.5

See footnote at end of table.

TABLE 4.--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*
CuB-----Crystal Lake	85	14	75	4.0	3.5
CvB-----Cushing	80	13	70	4.0	3.0
CvC2-----Cushing	70	12	60	3.5	3.0
CvD-----Cushing	60	10	50	3.5	2.5
CvE-----Cushing	---	---	40	3.0	2.0
CwD3-----Cushing	---	---	40	2.5	2.0
CxB-----Cushing	70	12	60	3.5	2.5
CxC2-----Cushing	60	11	50	3.0	2.5
CxD2-----Cushing	50	10	40	3.0	2.0
DaA-----Dakota	85	14	65	3.5	3.0
DaB-----Dakota	80	13	60	3.5	3.0
DlA-----Dakota	85	14	65	3.5	3.0
DvA-----Dakota Variant	80	13	65	3.5	3.0
EmD-----Emmert	---	---	---	---	1.8
FnB-----Freeon	80	14	75	3.7	3.5
HrB-----Hubbard	45	40	40	2.0	2.0
LnA-----Lino	60	12	60	2.5	2.5
MaA, MaB-----Magnor	80	14	70	3.5	3.5
Mk-----Markey	---	13	---	3.5	---
MnB, MnC-----Menahga	---	8	40	2.5	1.2
MnD-----Menahga	---	---	---	2.0	1.0
MoB-----Mora	80	14	70	3.5	3.5
Ns-----Newson	---	---	---	---	1.8
NyA-----Nymore	40	8	40	2.0	2.0

See footnote at end of table.

TABLE 4.--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*
OgB, OgC------------------ Omega	---	---	---	2.5	1.2
OgD---------------------- Omega	---	---	---	---	1.0
PvA---------------------- Plover	80	13	70	3.5	3.5
PxA---------------------- Poskin	80	13	70	3.5	3.5
Rf----------------------- Rifle	---	12	---	3.0	---
RoA---------------------- Rosholt	80	13	70	3.0	3.0
RoB---------------------- Rosholt	75	12	65	2.7	3.0
RoC2--------------------- Rosholt	70	11	50	2.5	2.5
RoD---------------------- Rosholt	60	9	45	2.5	2.5
RpB---------------------- Rosholt-Cromwell	60	11	65	2.5	2.3
RpC---------------------- Rosholt-Cromwell	50	10	45	2.0	2.0
RpD---------------------- Rosholt-Cromwell	---	---	40	2.0	1.9
RpE---------------------- Rosholt-Cromwell	---	---	---	---	1.6
RvB---------------------- Rosholt Variant	75	12	65	3.4	3.3
SaB---------------------- Santiago	85	14	70	3.5	4.0
SaC---------------------- Santiago	80	13	60	3.5	4.0
SaD---------------------- Santiago	75	12	65	3.0	3.5
ScB---------------------- Santiago-Antigo	80	14	70	3.5	4.0
ScC---------------------- Santiago-Antigo	75	13	60	3.0	3.8
ScD---------------------- Santiago-Antigo	70	11	55	2.9	3.5
Sm----------------------- Seelyeville	---	15	---	3.5	---
Wv----------------------- Warman Variant	---	---	---	---	1.8

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

TABLE 5.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas excluded. Absence of an entry means no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	2,000	---	---	---
II	203,625	170,079	13,205	20,341
III	129,910	115,042	12,818	2,050
IV	126,715	84,181	5,494	37,040
V	13,756	---	13,756	---
VI	104,479	39,339	42,670*	22,470
VII	8,371	7,901	---	470
VIII	6,564	---	3,964	2,600

* This acreage includes undrained areas of the organic Cathro, Markey, Rifle, and Seelyeville soils.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Important trees	Site index	Trees to plant
Ad------------------ Adolph	5w	Severe	Severe	Severe	Severe	Black ash-----------	38	Black spruce,
						Black spruce--------	---	white spruce.
AfA, AfB, AfC2----- Alban	2o	Slight	Slight	Slight	Moderate	Sugar maple---------	60	Red pine,
						American basswood---	---	eastern white pine,
						Yellow birch--------	---	white spruce.
AfD---------------- Alban	2r	Moderate	Slight	Slight	Moderate	Sugar maple---------	60	Red pine,
						American basswood---	---	eastern white pine,
						Yellow birch--------	---	white spruce.
Ag----------------- Alstad	2o	Slight	Slight	Slight	Moderate	Red maple-----------	65	Eastern white pine,
						American basswood---	---	white spruce,
						American elm--------	---	black spruce.
						Quaking aspen-------	---	
AlB, AlC----------- Amery	2o	Slight	Slight	Slight	Moderate	Northern red oak----	63	Red pine,
						Northern pin oak----	---	eastern white pine,
						White oak-----------	---	jack pine.
						White ash-----------	---	
						American basswood---	---	
AlD, AlE----------- Amery	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	63	Red pine,
						Northern pin oak----	---	eastern white pine,
						White oak-----------	---	jack pine.
						White ash-----------	---	
						American basswood---	---	
AnB, AnC, AoB*, AoC*-------------- Amery	2o	Slight	Slight	Slight	Moderate	Northern red oak----	63	Red pine,
						Northern pin oak----	---	eastern white pine,
						White oak-----------	---	jack pine.
						White ash-----------	---	
						American basswood---	---	
AoD*, AoE*--------- Amery	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	63	Red pine,
						Northern pin oak----	---	eastern white pine,
						White oak-----------	---	jack pine.
						White ash-----------	---	
						American basswood---	---	
ArC*--------------- Amery	2o	Slight	Slight	Slight	Moderate	Northern red oak----	63	Red pine,
						Northern pin oak----	---	eastern white pine,
						White oak-----------	---	jack pine.
						White ash-----------	---	
						American basswood---	---	
ArD*--------------- Amery	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	63	Red pine,
						Northern pin oak----	---	eastern white pine,
						White oak-----------	---	jack pine.
						White ash-----------	---	
						American basswood---	---	
AtA, AtB, AtC2----- Antigo	2o	Slight	Slight	Slight	Moderate	Sugar maple---------	63	Eastern white pine,
						American basswood---	---	red pine,
						Northern red oak----	---	white spruce.
						Eastern white pine--	---	
AuA---------------- Auburndale	3w	Severe	Moderate	Moderate	Severe	Red maple-----------	55	White spruce,
						American basswood---	---	black spruce,
						American elm--------	---	poplar.
						Balsam fir----------	---	
						Black ash-----------	---	
						Balsam poplar-------	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
Ba Barronett	5w	Severe	Severe	Severe	Severe	Tamarack Black ash Quaking aspen	30 --- ---	
Be Barronett Variant	5w	Severe	Severe	Severe	Severe	Tamarack Northern white-cedar	30 ---	
Bf Bluffton	3w	Severe	Severe	Severe	Severe	White ash White spruce Quaking aspen Black ash Red maple	55 --- --- --- ---	White spruce, black spruce.
BlA Brill	2o	Slight	Slight	Slight	Moderate	Sugar maple Yellow birch American basswood	60 --- ---	White spruce, eastern white pine, red pine.
CaA, CaB, CaC2 Campia	2o	Slight	Slight	Slight	Moderate	Northern red oak Sugar maple White ash American basswood	65 --- --- ---	Eastern white pine, red pine, white spruce.
CbB, CbC Campia Variant	2o	Slight	Slight	Slight	Moderate	Northern red oak Sugar maple White ash American basswood	65 --- --- ---	Eastern white pine, red pine, white spruce.
CbD Campia Variant	2r	Moderate	Slight	Slight	Moderate	Northern red oak Sugar maple White ash American basswood	65 --- --- ---	Eastern white pine, red pine, white spruce.
Cc Cathro	3w	Severe	Severe	Severe	Severe	Tamarack Balsam fir Silver maple	45 --- ---	
ChB, ChC2 Chetek	3s	Slight	Slight	Slight	Slight	Northern pin oak Jack pine Black oak White oak	55 --- --- ---	Red pine, jack pine.
ChD2 Chetek	3s	Moderate	Slight	Slight	Slight	Northern pin oak Jack pine Black oak White oak	55 --- --- ---	Red pine, jack pine.
CmA Comstock	2o	Slight	Slight	Slight	Moderate	Red maple American basswood Quaking aspen	65 --- ---	Eastern white pine, white spruce.
CpA Comstock Variant	2o	Slight	Slight	Slight	Moderate	Northern red oak American basswood White ash	65 --- ---	Red pine, eastern white pine, white spruce.
CrA, CrB, CrC Cromwell	2d	Slight	Moderate	Slight	Moderate	Red pine Quaking aspen Jack pine Eastern white pine	64 --- --- ---	Red pine, jack pine.
CrD Cromwell	2d	Moderate	Moderate	Slight	Moderate	Red pine Quaking aspen Jack pine Eastern white pine	64 --- --- ---	Red pine, jack pine.
CsA Cromwell Variant	2d	Slight	Slight	Slight	Slight	Northern pin oak White oak	65 ---	Red pine, eastern white pine.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Important trees	Site index	Trees to plant
CtA---------------- Croswell	2s	Slight	Severe	Slight	Severe	Red pine------------ Quaking aspen------- Jack pine----------- Northern red oak---- Black cherry-------- Eastern white pine-- Bigtooth aspen------ Sugar maple---------	63 --- --- --- --- --- --- ---	Red pine, eastern white pine.
CuA, CuB----------- Crystal Lake	2o	Slight	Slight	Slight	Moderate	Sugar maple--------- American basswood--- Yellow birch--------	60 --- ---	Eastern white pine, red pine, white spruce.
CvB, CvC2---------- Cushing	2o	Slight	Slight	Slight	Moderate	Sugar maple--------- Yellow birch-------- Eastern white pine-- Red maple----------- American basswood---	60 --- --- --- ---	Eastern white pine, red pine, white spruce.
CvD, CvE, CwD3----- Cushing	2r	Moderate	Slight	Slight	Moderate	Sugar maple--------- Yellow birch-------- Eastern white pine-- Red maple----------- American basswood---	60 --- --- --- ---	Eastern white pine, red pine, white spruce.
CxB*, CxC2*-------- Cushing	2o	Slight	Slight	Slight	Moderate	Sugar maple--------- Yellow birch-------- Eastern white pine-- Red maple----------- American basswood---	60 --- --- --- ---	Eastern white pine, red pine, white spruce.
CxD2*-------------- Cushing	2r	Moderate	Slight	Slight	Moderate	Sugar maple--------- Yellow birch-------- Eastern white pine-- Red maple----------- American basswood---	60 --- --- --- ---	Eastern white pine, red pine, white spruce.
EmD---------------- Emmert	4f	Severe	Severe	Slight	Moderate	Red pine------------ Eastern white pine-- Jack pine-----------	49 46 54	Jack pine, red pine.
Fa----------------- Fluvaquents	3o	Slight	Slight	Slight	Slight	Red maple----------- White ash-----------	58 ---	White spruce, black spruce, red maple, white ash.
Fe----------------- Fluvaquents, wet	4w	Moderate	Moderate	Moderate	Slight	Red maple----------- White ash-----------	48 ---	White spruce, black spruce, red maple, white ash.
FnB---------------- Freeon	2o	Slight	Slight	Slight	Moderate	Northern red oak---- Sugar maple--------- American basswood--- Red maple----------- Yellow birch-------- Red pine------------ Quaking aspen-------	65 --- --- --- --- --- ---	Red pine, eastern white pine, white spruce, black spruce.
HrB---------------- Hubbard	3s	Slight	Moderate	Slight	Slight	Red pine------------ Eastern white pine-- Jack pine-----------	56 --- ---	Red pine, eastern white pine, jack pine.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Important trees	Site index	Trees to plant
LnA---------------- Lino	3s	Slight	Moderate	Slight	Slight	Red pine------------ Eastern white pine-- Jack pine-----------	56 --- ---	White spruce, red pine, eastern white pine.
MaA, MaB----------- Magnor	2o	Slight	Slight	Slight	Slight	Sugar maple--------- Northern red oak---- American basswood---	59 --- ---	Eastern white pine, white spruce.
Mk----------------- Markey	3w	Severe	Severe	Severe	Severe	Tamarack------------ Balsam fir---------- Black ash----------- Quaking aspen------- Northern white-cedar	48 --- --- --- ---	
MnB, MnC----------- Menahga	3s	Slight	Moderate	Slight	Slight	Red pine------------ Jack pine----------- Northern pin oak---- White oak-----------	56 --- --- ---	Red pine, eastern white pine, jack pine.
MnD---------------- Menahga	3s	Severe	Moderate	Slight	Slight	Red pine------------ Jack pine----------- Northern pin oak---- White oak-----------	56 --- --- ---	Red pine, eastern white pine, jack pine.
MoB---------------- Mora	2o	Slight	Slight	Moderate	Moderate	Northern red oak---- Red pine------------ Eastern white pine-- White spruce-------- Sugar maple--------- Quaking aspen------- Jack pine-----------	64 --- --- --- --- --- ---	White spruce, red pine, eastern white pine.
Ns----------------- Newson	4w	Severe	Severe	Slight	Severe	Quaking aspen------- Paper birch--------- Eastern white pine--	50 --- ---	Eastern white pine, white spruce.
NyA---------------- Nymore	3s	Slight	Moderate	Slight	Moderate	Red pine------------ Eastern white pine-- Jack pine----------- White spruce--------	55 --- --- ---	Red pine, jack pine, eastern white pine.
OgB, OgC----------- Omega	3s	Slight	Moderate	Slight	Moderate	Red pine------------ Eastern white pine-- Jack pine-----------	56 --- ---	Red pine, jack pine, eastern white pine.
OgD---------------- Omega	3s	Moderate	Severe	Slight	Moderate	Red pine------------ Eastern white pine-- Jack pine-----------	56 --- ---	Red pine, jack pine, eastern white pine.
PvA---------------- Plover	2o	Slight	Slight	Slight	Moderate	Red maple----------- American basswood--- American elm-------- Yellow birch--------	65 --- --- ---	Eastern white pine, white spruce, black spruce.
PxA---------------- Poskin	2o	Slight	Slight	Slight	Moderate	Red maple----------- American basswood--- Eastern white pine--	65 --- ---	White spruce, eastern white pine.
Rf----------------- Rifle	3w	Severe	Severe	Severe	Severe	Tamarack------------ Northern white-cedar White spruce-------- Balsam fir----------	45 --- --- ---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Important trees	Site index	Trees to plant
RoA, RoB, RoC2-----Rosholt	2o	Slight	Slight	Slight	Moderate	Northern red oak----	62	Red pine, jack pine, eastern white pine.
						Black oak-----------	---	
						Northern pin oak----	---	
						Sugar maple---------	---	
RoD----------------Rosholt	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	62	Red pine, jack pine, eastern white pine.
						Black oak-----------	---	
						Northern pin oak----	---	
						Sugar maple---------	---	
RpB*, RpC*:								
Rosholt-----------	2o	Slight	Slight	Slight	Moderate	Northern red oak----	62	Red pine, jack pine, eastern white pine.
						Black oak-----------	---	
						Northern pin oak----	---	
						Sugar maple---------	---	
Cromwell----------	2d	Slight	Moderate	Slight	Moderate	Red pine------------	64	Red pine, jack pine.
						Quaking aspen-------	---	
						Jack pine-----------	---	
						Eastern white pine--	---	
RpD*, RpE*:								
Rosholt-----------	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	62	Red pine, jack pine, eastern white pine.
						Black oak-----------	---	
						Northern pin oak----	---	
						Sugar maple---------	---	
Cromwell----------	2d	Moderate	Moderate	Slight	Moderate	Red pine------------	64	Red pine, jack pine.
						Quaking aspen-------	---	
						Jack pine-----------	---	
						Eastern white pine--	---	
RvB----------------Rosholt Variant	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Eastern white pine, red pine, white spruce.
						Sugar maple---------	---	
						Eastern white pine--	---	
SaB, SaC-----------Santiago	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	
						American basswood---	---	
						White ash-----------	---	
						Red maple-----------	---	
SaD----------------Santiago	2r	Moderate	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	
						American basswood---	---	
						White ash-----------	---	
						Red maple-----------	---	
ScB*, ScC*:								
Santiago----------	2o	Slight	Slight	Slight	Moderate	Northern red oak----	65	Red pine, eastern white pine, white spruce.
						Sugar maple---------	---	
						American basswood---	---	
						White ash-----------	---	
						Red maple-----------	---	
Antigo------------	2o	Slight	Slight	Slight	Moderate	Sugar maple---------	63	Eastern white pine, red pine, white spruce.
						American basswood---	---	
						Northern red oak----	---	
						Eastern white pine--	---	

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	
ScD*:								
Santiago	2r	Moderate	Slight	Slight	Moderate	Northern red oak	65	Red pine, eastern white pine, white spruce.
						Sugar maple	---	
						American basswood	---	
						White ash	---	
						Red maple	---	
Antigo	2r	Moderate	Slight	Slight	Moderate	Sugar maple	63	Eastern white pine, red pine, white spruce.
						American basswood	---	
						Northern red oak	---	
						Eastern white pine	---	
Sm Seelyeville	3w	Severe	Severe	Severe	Severe	Tamarack	49	Black spruce.
						Black spruce	---	
Us Udorthents, sandy	4s	Severe	Severe	Slight	Slight	Northern pin oak	45	Red pine, jack pine.
						Black oak	---	
						White oak	---	
						Jack pine	---	
Uy Udorthents, loamy	3r	Severe	Severe	Slight	Slight	Northern pin oak	52	Red pine, jack pine.
						Black oak	---	
						White oak	---	
Wv Warman Variant	5w	Severe	Severe	Severe	Slight	Red maple	35	Red maple, white ash.
						White ash	---	
						American elm	---	
						Quaking aspen	---	

* See map unit description for the composition and behavior of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; the symbol > means greater than. Only soils suited to windbreaks and environmental plantings are listed. Absence of an entry means soil does not normally grow trees of this height class]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
AfA, AfB, AfC2, AfD--------------- Alban	---	Northern white-cedar, common ninebark, lilac, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
Ag----------------- Alstad	---	Nannyberry viburnum, silky dogwood, common ninebark.	White spruce------	Eastern white pine, silver maple, white ash.	---
AlB, AlC, AlD, AlE, AnB, AnC, AoB*, AoC*, AoD*, AoE*, ArC*, ArD*- Amery	---	Northern white-cedar, common ninebark, silky dogwood, lilac.	Norway spruce-----	Eastern white pine, red pine.	---
AtA, AtB, AtC2---- Antigo	---	Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine, green ash.	---
AuA--------------- Auburndale	---	Lilac, silky dogwood.	White spruce, black spruce.	Golden willow, green ash.	Eastern cottonwood.
Ba----------------- Barronett	---	Northern white-cedar, redosier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, silver maple, jack pine.	---
Be----------------- Barronett Variant	---	Northern white-cedar, redosier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, silver maple, jack pine.	---
BlA--------------- Brill	---	Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
BpA, BpB, BpC2---- Burkhardt	Manyflower cotoneaster.	Lilac, Siberian peashrub, common ninebark.	Norway spruce-----	Eastern white pine, red pine.	---
CaA, CaB, CaC2---- Campia	---	Northern white-cedar, common ninebark, lilac, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
CbB, CbC, CbD----- Campia Variant	---	Northern white-cedar, common ninebark, lilac, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---

See footnote at end of table.

TABLE 7.--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
ChB, ChC2, ChD2--- Chetek	Manyflower cotoneaster.	Lilac, Amur maple	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
CmA--------------- Comstock	---	Northern white-cedar, redosier dogwood, nannyberry viburnum, silky dogwood.	White spruce, spruce, black spruce.	Eastern white pine, silver maple, red pine, white ash.	---
CpA--------------- Comstock Variant	---	Nannyberry viburnum, northern white-cedar, redosier dogwood, silky dogwood.	White spruce, black spruce.	Eastern white pine, silver maple, red pine, white ash.	---
CrA, CrB, CrC, CrD-------------- Cromwell	---	Northern white-cedar, Russian-olive, Siberian crabapple, Siberian peashrub.	Norway spruce-----	Eastern white pine, red pine.	---
CsA--------------- Cromwell Variant	---	Northern white-cedar, Russian-olive, Siberian crabapple, Siberian peashrub.	Norway spruce-----	Eastern white pine, red pine.	---
CtA--------------- Croswell	Vanhoutte spirea	Lilac, arrowwood, silky dogwood.	White spruce------	Red pine, eastern white pine.	---
CuA, CuB---------- Crystal Lake	---	Northern white-cedar, common ninebark, lilac, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
CvB, CvC2, CvD, CvE, CwD3, CxB*, CxC2*, CxD2*----- Cushing	---	Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
DaA, DaB, DlA----- Dakota	---	Siberian crabapple, lilac, silky dogwood, gray dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
DvA--------------- Dakota Variant	---	Siberian crabapple, gray dogwood, lilac, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
FnB--------------- Freeon	Silky dogwood, gray dogwood.	Northern white-cedar, Amur maple, American cranberrybush.	White spruce, black spruce, Norway spruce, Siberian crabapple.	Eastern white pine, red pine, green ash.	---

See footnote at end of table.

TABLE 7.--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
HrB: Hubbard	---	Eastern redcedar, Siberian crabapple, northern white-cedar, silver buffaloberry, Russian-olive.	Norway spruce	Eastern white pine, red pine.	---
LnA: Lino	---	Northern white-cedar, lilac.	White spruce	Eastern white pine, red pine, jack pine.	---
MaA, MaB: Magnor	---	Northern white-cedar, silky dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, silver maple, red pine.	---
MnB, MnC, MnD: Menahga	Manyflower cotoneaster.	Eastern redcedar, Russian-olive, Siberian crabapple, silver buffaloberry, Siberian peashrub.	Norway spruce	Eastern white pine, red pine, jack pine.	---
MoB: Mora	---	Lilac, silky dogwood, nannyberry viburnum, common ninebark.	Amur maple, white spruce.	Red pine, eastern white pine.	---
NyA: Nymore	Manyflower cotoneaster.	Eastern redcedar, Siberian crabapple, Siberian peashrub.	Norway spruce	Eastern white pine, red pine, jack pine.	---
OgB, OgC, OgD: Omega	Manyflower cotoneaster.	Eastern redcedar, Russian-olive, Siberian peashrub.	Norway spruce	Eastern white pine, red pine, jack pine.	---
PvA: Plover	---	Nannyberry viburnum, silky dogwood.	White spruce, black spruce.	Eastern white pine, silver maple, red pine, white ash.	---
PxA: Poskin	---	Northern white-cedar, nannyberry viburnum, silky dogwood.	White spruce, black spruce.	Eastern white pine, silver maple, red pine, white ash.	---
RoA, RoB, RoC2, RoD: Rosholt	Manyflower cotoneaster.	Lilac, nannyberry viburnum, silky dogwood.	Norway spruce, white spruce.	Eastern white pine, jack pine, red pine.	---
RpB*, RpC*, RpD*, RpE*:					
Rosholt	Manyflower cotoneaster.	Lilac, nannyberry viburnum, silky dogwood.	Norway spruce, white spruce.	Eastern white pine, jack pine, red pine.	---

See footnote at end of table.

TABLE 7.--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
RpB*, RpC*, RpD*, RpE*:					
Cromwell	---	Northern white-cedar, Russian-olive, Siberian crabapple, Siberian peashrub.	Norway spruce	Eastern white pine, red pine.	---
RvB Rosholt Variant	---	Northern white-cedar, common ninebark, lilac, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
SaB, SaC, SaD Santiago	---	Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
ScB*, ScC*, ScD*:					
Santiago	---	Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
Antigo	---	Northern white-cedar, common ninebark, silky dogwood, lilac.	White spruce, Norway spruce.	Eastern white pine, red pine, green ash.	---
Wv Warman Variant	---	Northern white-cedar, redosier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	---

* See map unit description for the composition and behavior of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ad----------------- Adolph	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: floods, wetness.
AfA---------------- Alban	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
AfB---------------- Alban	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
AfC2--------------- Alban	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
AfD---------------- Alban	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ag----------------- Alstad	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: frost action, low strength.	Moderate: wetness.
AlB---------------- Amery	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action, low strength.	Slight.
AlC---------------- Amery	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, low strength, slope.	Moderate: slope.
AlD, AlE----------- Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
AnB---------------- Amery	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action, low strength.	Slight.
AnC---------------- Amery	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, low strength, slope.	Moderate: slope.
AoB*--------------- Amery	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action, low strength.	Slight.
AoC*--------------- Amery	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, low strength, slope.	Moderate: slope.
AoD*, AoE*--------- Amery	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ArC*--------------- Amery	Moderate: slope.	Slight---------	Slight---------	Moderate: low strength, slope.	Moderate: frost action, low strength.	Slight.

See footnote at end of table.

TABLE 8.--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
ArD*: Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
AtA: Antigo	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: low strength, frost action, shrink-swell.	Slight.
AtB: Antigo	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Moderate: low strength, frost action, shrink-swell.	Slight.
AtC2: Antigo	Severe: cutbanks cave.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Moderate: low strength, frost action, slope.	Moderate: slope.
AuA: Auburndale	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.	Severe: wetness, floods.
Ba: Barronett	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness.
Be: Barronett Variant	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.	Severe: wetness.
Bf: Bluffton	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: floods, wetness.
BlA: Brill	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: frost action.	Slight.
BpA: Burkhardt	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
BpB: Burkhardt	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
BpC2: Burkhardt	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
CaA: Campia	Moderate: cutbanks cave.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength, frost action.	Slight.
CaB: Campia	Moderate: cutbanks cave.	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Severe: low strength, frost action.	Slight.
CaC2: Campia	Moderate: slope, cutbanks cave.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
CbB: Campia Variant	Moderate: wetness, too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, wetness.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 8.--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
CbC: Campia Variant	Moderate: too clayey, slope.	Moderate: slope, low strength, shrink-swell.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
CbD: Campia Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Cc: Cathro	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, low strength, frost action.	Severe: excess humus, wetness, floods.
ChB: Chetek	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate.
ChC2: Chetek	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
ChD2: Chetek	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CmA: Comstock	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: frost action, low strength.	Moderate: wetness.
CpA: Comstock Variant	Severe: wetness, too clayey.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
CrA: Cromwell	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
CrB: Cromwell	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
CrC: Cromwell	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
CrD: Cromwell	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CsA: Cromwell Variant	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
CtA: Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Slight	Moderate: too sandy.
CuA: Crystal Lake	Moderate: wetness.	Moderate: low strength.	Moderate: wetness, low strength.	Moderate: low strength.	Severe: frost action, low strength.	Slight.
CuB: Crystal Lake	Moderate: wetness.	Moderate: low strength.	Moderate: wetness, low strength.	Moderate: slope, low strength.	Severe: frost action, low strength.	Slight.
CvB: Cushing	Slight	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, wetness.	Moderate: slope, low strength, shrink-swell.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 8.--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
CvC2-------------- Cushing	Moderate: slope.	Moderate: slope, low strength, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
CvD, CvE, CwD3---- Cushing	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
CxB*-------------- Cushing	Slight---------	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, wetness.	Moderate: slope, low strength, shrink-swell.	Severe: low strength.	Slight.
CxC2*------------- Cushing	Moderate: slope.	Moderate: slope, low strength, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
CxD2*------------- Cushing	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
DaA--------------- Dakota	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: low strength.	Slight.
DaB--------------- Dakota	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength.	Slight.
DlA--------------- Dakota	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: low strength.	Slight.
DvA--------------- Dakota Variant	Severe: wetness, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: frost action.	Moderate: wetness.
EmD--------------- Emmert	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, too sandy, small stones.
Fa*. Fluvaquents						
Fe*. Fluvaquents, wet						
FnB--------------- Freeon	Moderate: wetness.	Moderate: wetness, shrink-swell, low strength.	Severe: wetness.	Moderate: slope, wetness, shrink-swell.	Moderate: frost action, low strength, wetness.	Slight.
HrB--------------- Hubbard	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: too sandy.
LnA--------------- Lino	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: frost action, wetness.	Moderate: too sandy.
MaA, MaB---------- Magnor	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: frost action.	Moderate: wetness.
Mk---------------- Markey	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: excess humus, wetness, floods.

See footnote at end of table.

TABLE 8.--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
MnB: Menahga	Severe: cutbanks cave.	Slight	Slight	Slight	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.
MoB: Mora	Moderate: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: frost action.	Slight.
Ns: Newson	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
NyA: Nymore	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: too sandy.
OgB: Omega	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: too sandy.
OgC: Omega	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, too sandy.
OgD: Omega	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pg*. Pits						
PvA: Plover	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
PxA: Poskin	Severe: wetness, cutbanks cave.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: frost action.	Moderate: wetness.
Rf: Rifle	Severe: wetness, excess humus, cutbanks cave.	Severe: wetness, excess humus.	Severe: wetness, excess humus, low strength.	Severe: wetness, excess humus.	Severe: wetness, excess humus, frost action.	Severe: wetness, floods, excess humus.
RoA: Rosholt	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Severe: small stones.
RoB: Rosholt	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Severe: small stones.
RoC2: Rosholt	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, slope.	Severe: small stones.
RoD: Rosholt	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, small stones.
RpB*:						
Rosholt	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Severe: small stones.
Cromwell	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.

See footnote at end of table.

TABLE 8.--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*:						
Rosholt	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, slope.	Severe: small stones.
Cromwell	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
RpD*, RpE*:						
Rosholt	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, small stones.
Cromwell	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
RvB: Rosholt Variant	Moderate: depth to rock.	Moderate: shrink-swell, low strength.	Moderate: depth to rock, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Moderate: low strength, frost action.	Moderate: thin layer.
SaB: Santiago	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, frost action.	Slight.
SaC: Santiago	Moderate: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Moderate: low strength, frost action, slope.	Moderate: slope.
SaD: Santiago	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ScB*:						
Santiago	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength, frost action.	Slight.
Antigo	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Moderate: low strength, frost action, shrink-swell.	Slight.
ScC*:						
Santiago	Moderate: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Moderate: low strength, frost action, slope.	Moderate: slope.
Antigo	Severe: cutbanks cave.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Moderate: low strength, frost action, slope.	Moderate: slope.
ScD*:						
Santiago	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Antigo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--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
Se*. Saprists and Aquents						
Sm---------------- Seelyeville	Severe: wetness, excess humus, floods.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, excess humus.
Us*. Udorthents, sandy						
Uy*. Udorthents, loamy						
Wv---------------- Warman Variant	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness.

* See map unit description for the composition and behavior of the map unit.

TABLE 9.--SANITARY FACILITIES

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ad------------------ Adolph	Severe: wetness, floods, percs slowly.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
AfA----------------- Alban	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
AfB----------------- Alban	Slight-----------	Moderate: slope, seepage.	Slight-----------	Slight-----------	Good.
AfC2---------------- Alban	Moderate: slope.	Severe: slope.	Slight-----------	Moderate: slope.	Fair: slope.
AfD----------------- Alban	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Ag------------------ Alstad	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
AlB----------------- Amery	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Fair: thin layer.
AlC----------------- Amery	Moderate: percs slowly, slope.	Severe: slope.	Slight-----------	Moderate: slope.	Fair: thin layer, slope.
AlD----------------- Amery	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
AlE----------------- Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
AnB----------------- Amery	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Fair: thin layer.
AnC----------------- Amery	Moderate: percs slowly, slope.	Severe: slope.	Slight-----------	Moderate: slope.	Fair: thin layer, slope.
AoB*---------------- Amery	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Fair: thin layer.
AoC*---------------- Amery	Moderate: percs slowly, slope.	Severe: slope.	Slight-----------	Moderate: slope.	Fair: thin layer, slope.
AoD*---------------- Amery	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
AoE*---------------- Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
ArC*---------------- Amery	Moderate: percs slowly.	Severe: slope.	Slight-----------	Slight-----------	Fair: thin layer.
ArD*---------------- Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 9.--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
AtA, AtB------------ Antigo	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, small stones.
AtC2---------------- Antigo	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, small stones.
AuA----------------- Auburndale	Severe: wetness, floods, percs slowly.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness.
Ba------------------ Barronett	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Be------------------ Barronett Variant	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Bf------------------ Bluffton	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
BlA----------------- Brill	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, small stones.
BpA, BpB------------ Burkhardt	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
BpC2---------------- Burkhardt	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
CaA----------------- Campia	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
CaB----------------- Campia	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
CaC2---------------- Campia	Moderate: slope.	Severe: slope.	Slight-----------	Moderate: slope.	Fair: slope.
CbB----------------- Campia Variant	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Poor: too clayey.
CbC----------------- Campia Variant	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Poor: too clayey.
CbD----------------- Campia Variant	Severe: percs slowly, slope.	Severe: slope.	Severe: wetness, too clayey.	Severe: slope.	Poor: too clayey, slope.
Cc------------------ Cathro	Severe: wetness, floods.	Severe: wetness, excess humus, seepage.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, seepage.	Poor: excess humus, wetness.
ChB----------------- Chetek	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.

See footnote at end of table.

TABLE 9.--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
ChC2----------------- Chetek	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: small stones, slope.
ChD2----------------- Chetek	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: slope.
CmA------------------ Comstock	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
CpA------------------ Comstock Variant	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.
CrA, CrB------------- Cromwell	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
CrC------------------ Cromwell	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
CrD------------------ Cromwell	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: too sandy, slope.
CsA------------------ Cromwell Variant	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: too sandy.
CtA------------------ Croswell	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy.
CuA, CuB------------- Crystal Lake	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
CvB------------------ Cushing	Severe: percs slowly.	Moderate: slope.	Slight-----------	Slight-----------	Fair: too clayey.
CvC2----------------- Cushing	Severe: percs slowly.	Severe: slope.	Slight-----------	Moderate: slope.	Fair: slope, too clayey.
CvD------------------ Cushing	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
CvE------------------ Cushing	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
CwD3----------------- Cushing	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
CxB*----------------- Cushing	Severe: percs slowly.	Moderate: slope.	Slight-----------	Slight-----------	Fair: too clayey.
CxC2*---------------- Cushing	Severe: percs slowly.	Severe: slope.	Slight-----------	Moderate: slope.	Fair: slope, too clayey.
CxD2*---------------- Cushing	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 9.--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
DaA, DaB: Dakota	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: thin layer.
DlA: Dakota	Severe: depth to rock.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Fair: thin layer.
DvA: Dakota Variant	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness, seepage.	Poor: too sandy, seepage.
EmD: Emmert	Severe: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Fa*. Fluvaquents					
Fe*. Fluvaquents, wet					
FnB: Freeon	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Good.
HrB: Hubbard	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
LnA: Lino	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage.	Poor: too sandy, seepage.
MaA, MaB: Magnor	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
Mk: Markey	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: hard to pack, wetness.
MnB: Menahga	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
MnC: Menahga	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
MnD: Menahga	Severe: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope.
MoB: Mora	Severe: percs slowly, wetness.	Severe: seepage, wetness.	Moderate: wetness.	Severe: seepage.	Good.
Ns: Newson	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, too sandy.	Poor: wetness, too sandy.

See footnote at end of table.

TABLE 9.--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
NyA: Nymore	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
OgB: Omega	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy.
OgC: Omega	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy.
OgD: Omega	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Poor: slope, seepage, too sandy.
Pg*. Pits					
PvA: Plover	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Good.
PxA: Poskin	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: too sandy, small stones, seepage.
Rf: Rifle	Severe: floods, wetness.	Severe: wetness, excess humus, seepage.	Severe: wetness, seepage, excess humus.	Severe: floods, wetness, seepage.	Poor: excess humus, wetness, seepage.
RoA, RoB: Rosholt	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
RoC2: Rosholt	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
RoD: Rosholt	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: slope, small stones.
RpB*:					
Rosholt	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Cromwell	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
RpC*:					
Rosholt	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Cromwell	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
RpD*:					
Rosholt	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: slope, small stones.
Cromwell	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: too sandy, slope.

See footnote at end of table.

TABLE 9.--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
RpE*:					
Rosholt	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope, small stones.
Cromwell	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: too sandy, slope.
RvB Rosholt Variant	Severe: depth to rock.	Moderate: depth to rock, slope.	Severe: depth to rock.	Slight	Poor: area reclaim.
SaB Santiago	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
SaC Santiago	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
SaD Santiago	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
ScB*:					
Santiago	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
Antigo	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, small stones.
ScC*:					
Santiago	Severe: percs slowly.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
Antigo	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, small stones.
ScD*:					
Santiago	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Antigo	Severe: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: slope, seepage.	Poor: too sandy, small stones, slope.
Se*. Saprists and Aquents					
Sm Seelyeville	Severe: wetness, floods, percs slowly.	Severe: floods, seepage, wetness.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness, excess humus.
Us*. Udorthents, sandy					
Uy*. Udorthents, loamy					
Wv Warman Variant	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Severe: wetness, seepage, floods.	Poor: wetness.

* See map unit description for the composition and behavior of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ad: Adolph	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
AfA, AfB: Alban	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
AfC2: Alban	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope.
AfD: Alban	Fair: slope, low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
Ag: Alstad	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
AlB: Amery	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
AlC: Amery	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope.
AlD: Amery	Fair: slope, low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
AlE: Amery	Poor: slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
AnB: Amery	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
AnC: Amery	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope.
AoB*: Amery	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
AoC*: Amery	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope.
AoD*: Amery	Fair: slope, low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
AoE*: Amery	Poor: slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
ArC*: Amery	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
ArD*: Amery	Poor: slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
AtA, AtB: Antigo	Good	Good	Good	Good.
AtC2: Antigo	Good	Good	Good	Fair: slope.
AuA: Auburndale	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ba: Barronett	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Be: Barronett Variant	Poor: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: wetness.
Bf: Bluffton	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
BlA: Brill	Good	Good	Good	Good.
BpA, BpB: Burkhardt	Good	Good	Unsuited: excess fines.	Fair: area reclaim.
BpC2: Burkhardt	Good	Good	Unsuited: excess fines.	Fair: area reclaim, slope.
CaA, CaB: Campia	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CaC2: Campia	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
CbB: Campia Variant	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
CbC: Campia Variant	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
CbD: Campia Variant	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Cc: Cathro	Poor: excess humus, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, excess humus.
ChB: Chetek	Good	Good	Fair: excess fines.	Fair: area reclaim.
ChC2: Chetek	Good	Good	Fair: excess fines.	Fair: slope, area reclaim.
ChD2: Chetek	Fair: slope.	Good	Fair: excess fines.	Poor: slope.
CmA: Comstock	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CpA: Comstock Variant	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
CrA, CrB: Cromwell	Good	Good	Unsuited: excess fines.	Fair: thin layer.
CrC: Cromwell	Good	Good	Unsuited: excess fines.	Fair: slope, thin layer.
CrD: Cromwell	Fair: slope.	Good	Unsuited: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CsA-------------------- Cromwell Variant	Fair: wetness.	Good------------------	Unsuited: excess fines.	Good.
CtA-------------------- Croswell	Fair: wetness.	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
CuA, CuB--------------- Crystal Lake	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CvB-------------------- Cushing	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CvC2------------------- Cushing	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
CvD-------------------- Cushing	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
CvE-------------------- Cushing	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
CwD3------------------- Cushing	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
CxB*------------------- Cushing	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CxC2*------------------ Cushing	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
CxD2*------------------ Cushing	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
DaA, DaB--------------- Dakota	Good------------------	Good------------------	Poor: excess fines.	Good.
DlA-------------------- Dakota	Fair: low strength.	Poor: thin layer.	Unsuited: excess fines.	Good.
DvA-------------------- Dakota Variant	Fair: wetness.	Good------------------	Unsuited: excess fines.	Good.
EmD-------------------- Emmert	Fair: slope.	Good------------------	Good------------------	Poor: small stones, too sandy, slope.
Fa*. Fluvaquents				
Fe*. Fluvaquents, wet				
FnB-------------------- Freeon	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
HrB-------------------- Hubbard	Good------------------	Good------------------	Unsuited: excess fines.	Fair: too sandy.
LnA-------------------- Lino	Fair: wetness.	Good------------------	Unsuited: excess fines.	Fair: too sandy.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MaA, MaB------------- Magnor	Fair: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Mk------------------- Markey	Poor: excess humus, wetness.	Unsuited: excess humus.	Unsuited: excess fines, excess humus.	Poor: wetness, excess humus.
MnB, MnC------------- Menahga	Good-----------------	Good-----------------	Unsuited: excess fines.	Poor: too sandy.
MnD------------------ Menahga	Fair: slope.	Good-----------------	Unsuited: excess fines.	Poor: too sandy, slope.
MoB------------------ Mora	Fair: low strength, wetness.	Poor: excess fines.	Unsuited: excess fines.	Good.
Ns------------------- Newson	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
NyA------------------ Nymore	Good-----------------	Good-----------------	Unsuited: excess fines.	Poor: too sandy.
OgB------------------ Omega	Good-----------------	Good-----------------	Unsuited: excess fines.	Fair: too sandy.
OgC------------------ Omega	Good-----------------	Good-----------------	Unsuited: excess fines.	Fair: slope, too sandy.
OgD------------------ Omega	Fair: slope.	Good-----------------	Unsuited: excess fines.	Poor: slope.
Pg*. Pits				
PvA------------------ Plover	Fair: low strength, wetness.	Poor: excess fines.	Unsuited: excess fines.	Good.
PxA------------------ Poskin	Fair: wetness.	Good-----------------	Unsuited: excess fines.	Fair: thin layer.
Rf------------------- Rifle	Poor: excess humus.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness.
RoA, RoB------------- Rosholt	Good-----------------	Good-----------------	Good-----------------	Good.
RoC2----------------- Rosholt	Good-----------------	Good-----------------	Good-----------------	Fair: slope.
RoD------------------ Rosholt	Fair: slope.	Good-----------------	Good-----------------	Poor: slope.
RpB*:				
Rosholt--------------	Good-----------------	Good-----------------	Good-----------------	Good.
Cromwell-------------	Good-----------------	Good-----------------	Unsuited: excess fines.	Fair: thin layer.
RpC:				
Rosholt--------------	Good-----------------	Good-----------------	Good-----------------	Fair: slope.
Cromwell-------------	Good-----------------	Good-----------------	Unsuited: excess fines.	Fair: slope, thin layer.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RpD*:				
Rosholt	Fair: slope.	Good	Good	Poor: slope.
Cromwell	Fair: slope.	Good	Unsuited: excess fines.	Poor: slope.
RpE*:				
Rosholt	Poor: slope.	Good	Good	Poor: slope.
Cromwell	Poor: slope.	Good	Unsuited: excess fines.	Poor: slope.
RvB Rosholt Variant	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
SaB Santiago	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
SaC Santiago	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope.
SaD Santiago	Fair: low strength, slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
ScB*:				
Santiago	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
Antigo	Good	Good	Good	Good.
ScC*:				
Santiago	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope.
Antigo	Good	Good	Good	Fair: slope.
ScD*:				
Santiago	Fair: low strength, slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
Antigo	Fair: slope.	Good	Good	Poor: slope.
Se*. Saprists and Aquents				
Sm Seelyeville	Poor: low strength, wetness.	Unsuited: excess humus.	Unsuited: excess humus.	Poor: wetness, excess humus.
Us*. Udorthents, sandy				
Uy*. Udorthents, loamy				
Wv Warman Variant	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness.

* See map unit description for the composition and behavior of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Ad: Adolph	Favorable	Wetness	Slow refill	Floods, frost action.	Not needed	Wetness.
AfA: Alban	Seepage	Piping	No water	Not needed	Not needed	Favorable.
AfB: Alban	Seepage	Piping	No water	Not needed	Soil blowing	Favorable.
AfC2: Alban	Seepage, slope.	Piping	No water	Not needed	Soil blowing	Slope.
AfD: Alban	Slope, seepage.	Piping	No water	Not needed	Slope, soil blowing.	Slope.
Ag: Alstad	Seepage	Wetness	Slow refill	Frost action	Not needed	Wetness.
AlB: Amery	Seepage	Piping	No water	Not needed	Soil blowing	Favorable.
AlC: Amery	Seepage, slope.	Piping	No water	Not needed	Soil blowing	Slope.
AlD, AlE: Amery	Seepage, slope.	Piping	No water	Not needed	Soil blowing, slope.	Slope.
AnB: Amery	Seepage	Piping	No water	Not needed	Favorable	Favorable.
AnC: Amery	Seepage, slope.	Piping	No water	Not needed	Favorable	Slope.
AoB*: Amery	Seepage	Piping	No water	Not needed	Soil blowing	Favorable.
AoC*: Amery	Seepage, slope.	Piping	No water	Not needed	Soil blowing	Slope.
AoD*, AoE*: Amery	Seepage, slope.	Piping	No water	Not needed	Soil blowing, slope.	Slope.
ArC*: Amery	Seepage, slope.	Piping	No water	Not needed	Soil blowing	Favorable.
ArD*: Amery	Seepage, slope.	Piping	No water	Not needed	Soil blowing, slope.	Slope.
AtA: Antigo	Seepage	Seepage	No water	Not needed	Not needed	Erodes easily.
AtB: Antigo	Seepage	Seepage	No water	Not needed	Favorable	Erodes easily.
AtC2: Antigo	Seepage, slope.	Seepage	No water	Not needed	Favorable	Slope, erodes easily.
AuA: Auburndale	Seepage	Wetness	Slow refill	Floods, frost action.	Not needed	Erodes easily, wetness.
Ba: Barronett	Favorable	Wetness	Slow refill	Floods, frost action.	Not needed	Wetness, erodes easily.
Be: Barronett Variant	Seepage	Piping	Slow refill	Floods, frost action.	Not needed	Wetness.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Bf----------------- Bluffton	Favorable------	Piping, wetness.	Slow refill----	Floods, frost action.	Not needed-----	Wetness.
BlA---------------- Brill	Seepage--------	Seepage--------	Deep to water	Not needed-----	Not needed-----	Favorable.
BpA---------------- Burkhardt	Seepage--------	Seepage--------	No water-------	Not needed-----	Not needed-----	Droughty.
BpB---------------- Burkhardt	Seepage--------	Seepage--------	No water-------	Not needed-----	Soil blowing---	Droughty.
BpC2--------------- Burkhardt	Seepage, slope.	Seepage--------	No water-------	Not needed-----	Soil blowing---	Droughty, slope.
CaA---------------- Campia	Seepage--------	Piping---------	No water-------	Not needed-----	Not needed-----	Erodes easily.
CaB---------------- Campia	Seepage--------	Piping---------	No water-------	Not needed-----	Favorable------	Erodes easily.
CaC2--------------- Campia	Seepage--------	Piping---------	No water-------	Not needed-----	Favorable------	Slope, erodes easily.
CbB---------------- Campia Variant	Favorable------	Favorable------	Deep to water, slow refill.	Not needed-----	Favorable------	Favorable.
CbC---------------- Campia Variant	Slope----------	Favorable------	Deep to water, slow refill.	Not needed-----	Favorable------	Slope.
CbD---------------- Campia Variant	Slope----------	Favorable------	Deep to water, slow refill.	Not needed-----	Slope----------	Slope.
Cc----------------- Cathro	Seepage--------	Excess humus, wetness, piping.	Favorable------	Floods, excess humus, frost action.	Not needed-----	Wetness.
ChB---------------- Chetek	Seepage--------	Seepage--------	No water-------	Not needed-----	Soil blowing---	Droughty.
ChC2--------------- Chetek	Seepage, slope.	Seepage--------	No water-------	Not needed-----	Soil blowing---	Droughty, slope.
ChD2--------------- Chetek	Seepage, slope.	Seepage--------	No water-------	Not needed-----	Slope, soil blowing.	Droughty, slope.
CmA---------------- Comstock	Seepage--------	Wetness, piping.	Slow refill----	Favorable------	Not needed-----	Wetness, erodes easily.
CpA---------------- Comstock Variant	Favorable------	Wetness--------	Slow refill----	Percs slowly, frost action.	Not needed-----	Percs slowly, wetness.
CrA, CrB----------- Cromwell	Seepage, slope.	Seepage--------	No water-------	Not needed-----	Too sandy, soil blowing.	Droughty.
CrC---------------- Cromwell	Seepage, slope.	Seepage--------	No water-------	Not needed-----	Too sandy, soil blowing.	Slope, droughty.
CrD---------------- Cromwell	Seepage--------	Seepage--------	No water-------	Not needed-----	Slope, too sandy, soil blowing.	Slope, droughty.
CsA---------------- Cromwell Variant	Seepage--------	Seepage, wetness.	Deep to water	Frost action---	Not needed-----	Droughty, wetness.
CtA---------------- Croswell	Seepage--------	Seepage, piping.	Deep to water	Not needed-----	Not needed-----	Droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
CuA Crystal Lake	Seepage	Wetness	Slow refill	Favorable	Not needed	Erodes easily.
CuB Crystal Lake	Seepage	Wetness	Slow refill	Favorable	Wetness	Erodes easily.
CvB Cushing	Seepage	Piping	No water	Not needed	Favorable	Favorable.
CvC2 Cushing	Seepage, slope.	Piping	No water	Not needed	Favorable	Slope.
CvD, CvE Cushing	Slope, seepage.	Piping	No water	Not needed	Slope	Slope.
CwD3 Cushing	Slope, seepage.	Piping	No water	Not needed	Slope	Slope.
CxB* Cushing	Seepage	Piping	No water	Not needed	Favorable	Favorable.
CxC2* Cushing	Seepage, slope.	Piping	No water	Not needed	Favorable	Slope.
CxD2* Cushing	Slope, seepage.	Piping	No water	Not needed	Slope	Slope.
DaA Dakota	Seepage	Seepage	No water	Not needed	Not needed	Favorable.
DaB Dakota	Seepage	Seepage	No water	Not needed	Favorable	Favorable.
DlA Dakota	Depth to rock, seepage.	Thin layer	No water	Not needed	Not needed	Favorable.
DvA Dakota Variant	Seepage	Seepage, wetness.	Deep to water	Wetness, frost action.	Not needed	Wetness.
EmD Emmert	Slope, seepage.	Seepage	No water	Not needed	Slope, too sandy.	Slope, droughty.
Fa*. Fluvaquents						
Fe*. Fluvaquents, wet						
FnB Freeon	Favorable	Wetness	Slow refill	Not needed	Wetness	Erodes easily.
HrB Hubbard	Seepage	Seepage	No water	Not needed	Too sandy, soil blowing.	Droughty.
LnA Lino	Seepage	Piping, seepage, wetness.	Deep to water	Favorable	Not needed	Droughty.
MaA Magnor	Seepage	Wetness	Slow refill	Frost action	Not needed	Wetness, erodes easily.
MaB Magnor	Seepage	Wetness	Slow refill	Frost action	Wetness	Wetness, erodes easily.
Mk Markey	Seepage	Seepage, excess humus, wetness.	Favorable	Floods, frost action, excess humus.	Not needed	Wetness.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
MnB: Menahga	Seepage	Seepage	No water	Not needed	Too sandy, soil blowing.	Droughty.
MnC: Menahga	Seepage, slope.	Seepage	No water	Not needed	Too sandy, soil blowing.	Droughty, slope.
MnD: Menahga	Seepage, slope.	Seepage	No water	Not needed	Slope, too sandy, soil blowing.	Droughty, slope.
MoB: Mora	Favorable	Piping, wetness.	Slow refill	Frost action	Wetness	Wetness.
Ns: Newson	Seepage	Seepage	Favorable	Favorable	Not needed	Wetness, droughty.
NyA: Nymore	Seepage	Piping	No water	Not needed	Not needed	Droughty.
OgB: Omega	Seepage	Piping, seepage.	No water	Not needed	Too sahdy, soil blowing.	Droughty.
OgC: Omega	Seepage, slope.	Piping, seepage.	No water	Not needed	Too sandy, soil blowing.	Slope, droughty.
OgD: Omega	Seepage, slope.	Piping, seepage.	No water	Not needed	Slope, too sandy, soil blowing.	Slope, droughty.
Pg*. Pits						
PvA: Plover	Seepage	Wetness, piping.	Slow refill	Frost action	Not needed	Wetness.
PxA: Poskin	Seepage	Seepage, wetness.	Slow refill	Frost action	Not needed	Erodes easily wetness.
Rf: Rifle	Seepage	Excess humus, wetness.	Favorable	Excess humus, floods, frost action.	Not needed	Not needed.
RoA: Rosholt	Seepage	Seepage	No water	Not needed	Not needed	Favorable.
RoB: Rosholt	Seepage	Seepage	No water	Not needed	Favorable	Favorable.
RoC2: Rosholt	Seepage, slope.	Seepage	No water	Not needed	Favorable	Slope.
RoD: Rosholt	Seepage, slope.	Seepage	No water	Not needed	Slope	Slope.
RpB*:						
Rosholt	Seepage	Seepage	No water	Not needed	Favorable	Favorable.
Cromwell	Seepage	Seepage	No water	Not needed	Too sandy, soil blowing.	Droughty.
RpC*:						
Rosholt	Seepage, slope.	Seepage	No water	Not needed	Favorable	Slope.
Cromwell	Seepage, slope.	Seepage	No water	Not needed	Too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
RpD*, RpE*:						
Rosholt	Seepage, slope.	Seepage	No water	Not needed	Slope	Slope.
Cromwell	Seepage, slope.	Seepage	No water	Not needed	Slope, too sandy, soil blowing.	Slope, droughty.
RvB Rosholt Variant	Depth to rock, seepage.	Thin layer	No water	Not needed	Depth to rock	Depth to rock.
SaB Santiago	Favorable	Piping	No water	Not needed	Favorable	Erodes easily.
SaC Santiago	Slope	Piping	No water	Not needed	Favorable	Slope, erodes easily.
SaD Santiago	Slope	Piping	No water	Not needed	Slope	Slope, erodes easily.
ScB*:						
Santiago	Favorable	Piping	No water	Not needed	Favorable	Erodes easily.
Antigo	Seepage	Seepage	No water	Not needed	Favorable	Erodes easily.
ScC*:						
Santiago	Slope	Piping	No water	Not needed	Favorable	Slope, erodes easily.
Antigo	Seepage, slope.	Seepage	No water	Not needed	Favorable	Slope, erodes easily.
ScD*:						
Santiago	Slope	Piping	No water	Not needed	Slope	Slope, erodes easily.
Antigo	Seepage, slope.	Seepage	No water	Not needed	Slope	Slope, erodes easily.
Se*. Saprists and Aquents						
Sm Seelyeville	Seepage	Excess humus, wetness.	Favorable	Floods, frost action, excess humus.	Not needed	Wetness.
Us*. Udorthents, sandy						
Uy*. Udorthents, loamy						
Wv Warman Variant	Seepage	Seepage	Favorable	Floods, frost action.	Not needed	Wetness.

* See map unit description for the composition and behavior of the map unit.

TABLE 12.--RECREATIONAL DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ad: Adolph	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.
AfA: Alban	Slight	Slight	Slight	Slight	Slight.
AfB: Alban	Slight	Slight	Moderate: slope.	Slight	Slight.
AfC2: Alban	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
AfD: Alban	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Ag: Alstad	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
AlB: Amery	Slight	Slight	Moderate: slope.	Slight	Slight.
AlC: Amery	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
AlD: Amery	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
AlE: Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
AnB: Amery	Slight	Slight	Moderate: slope.	Slight	Slight.
AnC: Amery	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
AoB*: Amery	Slight	Slight	Moderate: slope.	Slight	Slight.
AoC*: Amery	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
AoD*: Amery	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
AoE*: Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ArC*: Amery	Slight	Slight	Severe: slope.	Slight	Slight.
ArD*: Amery	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
AtA: Antigo	Slight	Slight	Slight	Slight	Slight.
AtB: Antigo	Slight	Slight	Moderate: slope.	Slight	Slight.
AtC2: Antigo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AuA: Auburndale	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
Ba: Barronett	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Be: Barronett Variant	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Bf: Bluffton	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: floods, wetness.
BlA: Brill	Slight	Slight	Slight	Slight	Slight.
BpA: Burkhardt	Slight	Slight	Slight	Slight	Slight.
BpB: Burkhardt	Slight	Slight	Moderate: slope.	Slight	Slight.
BpC2: Burkhardt	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
CaA: Campia	Slight	Slight	Slight	Slight	Slight.
CaB: Campia	Slight	Slight	Moderate: slope.	Slight	Slight.
CaC2: Campia	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
CbB: Campia Variant	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight	Slight.
CbC: Campia Variant	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
CbD: Campia Variant	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Cc: Cathro	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: excess humus, wetness, floods.
ChB: Chetek	Slight	Slight	Moderate: slope.	Slight	Slight.
ChC2: Chetek	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
ChD2: Chetek	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
CmA: Comstock	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
CpA: Comstock Variant	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
CrA: Cromwell	Slight	Slight	Slight	Slight	Slight.
CrB: Cromwell	Slight	Slight	Moderate: slope.	Slight	Slight.
CrC: Cromwell	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
CrD: Cromwell	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
CsA: Cromwell Variant	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
CtA: Croswell	Moderate: too sandy, wetness.	Moderate: too sandy, wetness.	Moderate: too sandy, wetness.	Moderate: too sandy.	Moderate: too sandy.
CuA: Crystal Lake	Slight	Slight	Slight	Slight	Slight.
CuB: Crystal Lake	Slight	Slight	Moderate: slope.	Slight	Slight.
CvB: Cushing	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight	Slight.
CvC2: Cushing	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
CvD: Cushing	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
CvE: Cushing	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CwD3: Cushing	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.
CxB*: Cushing	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight	Slight.
CxC2: Cushing	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
CxD2*: Cushing	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
DaA: Dakota	Slight	Slight	Slight	Slight	Slight.
DaB: Dakota	Slight	Slight	Moderate: slope.	Slight	Slight.
DlA: Dakota	Slight	Slight	Slight	Slight	Slight.
DvA: Dakota Variant	Severe: floods.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
EmD------------------- Emmert	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: slope, too sandy, small stones.
Fa*. Fluvaquents					
Fe*. Fluvaquents, wet					
FnB------------------- Freeon	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Slight------------	Slight.
HrB------------------- Hubbard	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: too sandy.
LnA------------------- Lino	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: too sandy.	Moderate: too sandy.
MaA, MaB-------------- Magnor	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Mk-------------------- Markey	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness, floods.
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.
MoB------------------- Mora	Moderate: percs slowly.	Moderate: wetness.	Moderate: slope, wetness.	Slight------------	Slight.
Ns-------------------- Newson	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
NyA------------------- Nymore	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
OgB------------------- Omega	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
OgC------------------- Omega	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: too sandy.
OgD------------------- Omega	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope, too sandy.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Pg*. Pits					
PvA------------------- Plover	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
PxA------------------- Poskin	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Rf-------------------- Rifle	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.
RoA------------------- Rosholt	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
RoB------------------- Rosholt	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
RoC2------------------ Rosholt	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.
RoD------------------- Rosholt	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
RpB*:					
Rosholt--------------	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
Cromwell-------------	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
RpC*:					
Rosholt--------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.
Cromwell-------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.
RpD*:					
Rosholt--------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Cromwell-------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
RpE*:					
Rosholt--------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cromwell-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
RvB------------------- Rosholt Variant	Slight----------	Slight----------	Moderate: slope, depth to rock.	Slight------------	Moderate: thin layer.
SaB------------------- Santiago	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
SaC------------------- Santiago	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SaD: Santiago	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
ScB*:					
Santiago	Slight	Slight	Moderate: slope.	Slight	Slight.
Antigo	Slight	Slight	Moderate: slope.	Slight	Slight.
ScC*:					
Santiago	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Antigo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
ScD*:					
Santiago	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Antigo	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Se*. Saprists and Aquents					
Sm: Seelyeville	Severe: excess humus, wetness, floods.	Severe: excess humus, wetness.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.
Us*. Udorthents, sandy					
Uy*. Udorthents, loamy					
Wv: Warman Variant	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

* See map unit description for the composition and behavior of the map unit.

TABLE 13.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates 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
Ad: Adolph	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Fair.
AfA, AfB: Alban	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AfC2: Alban	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AfD: Alban	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ag: Alstad	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
AlB: Amery	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AlC: Amery	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AlD: Amery	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AlE: Amery	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
AnB: Amery	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AnC: Amery	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AoB*: Amery	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AoC*: Amery	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AoD*: Amery	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AoE*: Amery	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
ArC*: Amery	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ArD*: Amery	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
AtA, AtB: Antigo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AtC2: Antigo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AuA: Auburndale	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
Ba: Barronett	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Be: Barronett Variant	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Bf: Bluffton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
BlA: Brill	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
BpA, BpB, BpC2: Burkhardt	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
CaA, CaB: Campia	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CaC2: Campia	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CbB: Campia Variant	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CbC: Campia Variant	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CbD: Campia Variant	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Cc: Cathro	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
ChB, ChC2: Chetek	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
ChD2: Chetek	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
CmA: Comstock	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CpA: Comstock Variant	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
CrA, 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.	Fair	Fair	Very poor.
CsA: Cromwell Variant	Fair	Fair	Fair	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
CtA: Croswell	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
CuA, CuB: Crystal Lake	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CvB: Cushing	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CvC2: Cushing	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CvD: Cushing	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
CvE: Cushing	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CwD3: Cushing	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
CxB*: Cushing	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CxC2*: Cushing	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CxD2*: Cushing	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
DaA, DaB, DlA: Dakota	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
DvA: Dakota Variant	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
EmD: Emmert	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Fa*. Fluvaquents										
Fe*. Fluvaquents, wet										
FnB: Freeon	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
HrB: Hubbard	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
LnA: Lino	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor.
MaA, MaB: Magnor	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Mk: Markey	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
MnB, MnC: Menahga	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
MnD: Menahga	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
MoB: Mora	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ns: Newson	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
NyA: Nymore	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
OgB, OgC, OgD: Omega	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Pg*. Pits										

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
PvA----------------- Plover	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
PxA----------------- Poskin	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Rf------------------ Rifle	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
RoA, RoB------------ Rosholt	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RoC2---------------- 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.
Cromwell-----------	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
RpC*:										
Rosholt------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Cromwell-----------	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
RpD*:										
Rosholt------------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Cromwell-----------	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
RpE*:										
Rosholt------------	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Cromwell-----------	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
RvB----------------- Rosholt Variant	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SaB, SaC, SaD------- Santiago	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ScB*:										
Santiago-Antigo----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ScC*, ScD*:										
Santiago-----------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Antigo-------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Se*. Saprists and Aquents										

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Sm: Seelyeville	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Us*. Udorthents, sandy										
Uy*. Udorthents, loamy										
Wv: Warman Variant	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

* See map unit description for the composition and behavior of the map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ad----------------- Adolph	0-10	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	90-100	85-100	80-95	30-50	4-24
	10-25	Silt loam, very fine sandy loam, loam.	ML	A-4	0	100	90-100	85-100	80-95	30-40	5-10
	25-60	Sandy loam, fine sandy loam, gravelly sandy loam.	SM	A-4, A-2	0-2	85-95	65-95	50-80	30-45	<30	NP-3
AfA, AfB, AfC2, AfD Alban	0-8	Fine sandy loam	ML, SM	A-2, A-4	0	100	100	60-85	30-55	<20	1-4
	8-20	Loamy sand, sandy loam, silt loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	100	100	50-100	15-90	<20	NP-5
	20-56	Loamy fine sand, fine sandy loam, very fine sandy loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	60-95	30-65	<20	2-6
	56-60	Fine sandy loam, fine sand, silt loam.	SM, ML	A-4	0	100	100	75-100	35-100	<30	NP-7
Ag----------------- Alstad	0-16	Loam------------	ML, CL, CL-ML	A-4	0	100	95-100	85-100	70-90	20-30	3-10
	16-20	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-2	95-100	85-95	80-90	60-80	20-29	5-12
	20-45	Loam, sandy clay loam, clay loam.	CL	A-6	0-5	95-100	85-95	60-90	50-70	25-40	10-21
	45-60	Loam, sandy clay loam, clay loam.	SC, CL	A-4, A-6	0-5	90-100	85-95	55-90	45-65	25-40	10-20
AlB, AlC, AlD, AlE- Amery	0-19	Sandy loam------	SM, ML	A-4, A-2	0	100	100	60-85	30-55	<20	1-4
	19-35	Sandy loam, fine sandy loam, loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0-2	85-100	85-95	65-80	25-65	<20	2-6
	35-60	Loamy sand, sandy loam, fine sandy loam.	SM, SC, SM-SC	A-4, A-2	0-5	85-100	85-95	50-85	15-50	<25	NP-9
AnB, AnC----------- Amery	0-19	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	85-100	60-90	20-30	3-10
	19-38	Sandy loam, fine sandy loam, loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0-2	85-100	85-95	65-80	25-65	<20	2-6
	38-60	Loamy sand, sandy loam, fine sandy loam.	SM, SC, SM-SC	A-4, A-2	0-5	85-100	85-95	50-85	15-50	<25	NP-9

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
AoB*, AoC*, AoD*, AoE*, ArC*, ArD*-- Amery	0-19	Sandy loam------	SM, ML	A-4, A-2	0	100	100	60-85	30-55	<20	1-4
	19-35	Sandy loam, fine sandy loam, loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0-2	85-100	85-95	65-80	25-65	<20	2-6
	35-60	Loamy sand, sandy loam, fine sandy loam.	SM, SC, SM-SC	A-4, A-2	0-5	85-100	85-95	50-85	15-50	<25	NP-9
AtA, AtB, AtC2----- Antigo	0-10	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	80-100	20-30	3-10
	10-14	Silt loam, silt	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	15-30	2-12
	14-30	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	80-95	70-90	25-45	10-25
	30-34	Loam, sandy loam, gravelly sandy loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	85-100	80-100	50-85	25-65	<20	2-6
	34-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-2, A-3, A-1	0-3	50-90	40-85	25-55	2-10	---	NP
AuA---------------- Auburndale	0-13	Silt loam-------	CL, ML, CL-ML	A-4	0	100	100	95-100	95-100	20-30	2-10
	13-31	Silt loam-------	CL	A-6	0	100	100	95-100	70-100	25-35	10-20
	31-60	Loam, silt, silt loam.	CL, CL-ML	A-4	0-5	95-100	90-100	85-100	60-100	20-30	5-10
Ba----------------- Barronett	0-16	Silt loam-------	ML	A-4	0	100	100	85-100	60-90	20-30	NP-5
	16-34	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	100	100	90-100	75-100	25-45	9-25
	34-60	Stratified silty clay loam to fine sand.	CL, ML, SM, SC	A-4, A-6	0	95-100	95-100	75-100	20-95	20-30	NP-12
Be----------------- Barronett Variant	0-12	Fine sandy loam	ML, SM	A-4	0	100	100	70-85	40-55	<20	1-4
	12-31	Loamy fine sand, silt loam, silt.	ML, SM, SM-SC, CL	A-4	0	100	100	50-100	35-85	<20	1-5
	31-60	Stratified fine sand to silty clay.	SM, SC, ML, CL	A-4, A-6, A-2	0	100	100	65-100	20-95	10-35	3-18
Bf----------------- Bluffton	0-10	Loam------------	CL, SC	A-6, A-7	0	98-100	85-100	85-95	45-80	30-45	10-20
	10-26	Fine sandy loam, loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0-3	95-100	85-100	70-90	40-60	20-35	3-18
	26-60	Loam, sandy clay loam, fine sandy loam.	CL, ML, SC, SM	A-6, A-4	0-5	90-100	85-100	70-90	40-65	20-40	3-20

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
BlA----------------- Brill	0-7	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	7-14	Silt loam, silt	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	15-30	2-12
	14-32	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	90-100	80-90	70-90	25-45	10-25
	32-39	Silt loam, loam, sandy loam.	ML, CL, SM, SC	A-4, A-2	0-3	85-100	80-100	60-100	30-90	<30	NP-10
	39-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-2, A-3, A-1	0-3	50-90	40-85	25-55	2-10	---	NP
BpA, BpB, BpC2----- Burkhardt	0-11	Sandy loam-------	SM	A-2, A-4	0	95-100	95-100	60-70	30-40	<26	NP-4
	11-19	Sandy loam, loam	SM, ML	A-2, A-4	0	95-100	85-100	60-95	30-75	<25	1-4
	19-60	Sand and gravel	SP	A-1	0	75-85	60-85	20-35	1-5	---	NP
CaA, CaB, CaC2----- Campia	0-14	Silt loam--------	CL-ML, CL	A-4	0	100	100	90-100	70-90	20-30	5-10
	14-39	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	30-39	13-22
	39-60	Silt loam, silt	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-95	20-35	6-15
CbB, CbC, CbD------ Campia Variant	0-7	Loam-------------	ML, CL-ML	A-4	0	100	95-100	85-95	60-75	20-30	1-5
	7-11	Loam, silty clay loam.	CL	A-7	0	100	95-100	85-100	60-95	40-50	20-30
	11-29	Silty clay, silty clay loam.	CL	A-7	0	100	100	95-100	85-95	40-49	23-29
	29-60	Stratified clay to fine sand.	CL, ML, SM, SC	A-7, A-6, A-4, A-2	0	100	100	65-100	20-95	10-49	2-29
Cc------------------ Cathro	0-39	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	39-60	Stratified silt and very fine sand.	SM, ML, SC, CL	A-4	0	100	95-100	60-100	35-90	15-26	3-10
ChB, ChC2, ChD2---- Chetek	0-8	Sandy loam-------	SM, ML	A-2, A-4	0	95-100	95-100	60-85	25-55	<25	NP-4
	8-17	Loam, sandy loam	ML, CL-ML, SM, SM-SC	A-2, A-4	0	95-100	95-100	60-95	25-65	15-31	2-12
	17-60	Sand and gravel	SP, SP-SM	A-1	0	80-95	65-75	40-50	1-5	---	NP
CmA----------------- Comstock	0-15	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	15-34	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	30-39	13-22
	34-60	Stratified silt to very fine sand.	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-95	20-35	6-15
CpA----------------- Comstock Variant	0-7	Loam-------------	ML, CL-ML	A-4	0	95-100	95-100	85-95	60-75	20-30	1-5
	7-14	Fine sandy loam, sandy loam, loam.	ML, SM, CL-ML, SM-SC.	A-4, A-2	0	95-100	95-100	60-95	30-75	10-19	1-5
	14-34	Silty clay, silty clay loam.	CL	A-7	0	100	100	95-100	85-95	40-49	23-29
	34-60	Silty clay, silty clay loam.	CL	A-7	0	100	100	95-100	85-95	40-49	23-29

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
CrA, CrB, CrC, CrD-- Cromwell	0-13	Sandy loam------	SM	A-4, A-2	0	95-100	90-100	55-85	20-45	<20	NP
	13-60	Sand, cobbly loamy sand.	SM, SP, SP-SM	A-1, A-3, A-2	0-20	85-100	60-100	35-70	0-15	<20	NP
CsA---------------- Cromwell Variant	0-16	Sandy loam------	SM, SM-SC	A-4, A-2	0	95-100	90-100	60-80	30-60	<20	2-6
	16-20	Loamy sand, gravelly sandy loam, gravelly loamy sand.	SM	A-2, A-4	0-5	85-100	75-100	50-75	15-40	---	NP
	20-60	Coarse sand and gravel.	SM, SP, SP-SM	A-3, A-2	0-5	80-100	70-90	50-70	0-15	---	NP
CtA---------------- Croswell	0-8	Loamy sand------	SM	A-2	0	100	95-100	50-75	15-30	<20	NP-4
	8-40	Sand------------	SP-SM, SM	A-3, A-2-4	0	100	95-100	50-70	5-25	---	NP
	40-60	Sand------------	SP-SM, SM	A-3, A-2-4	0	100	95-100	50-70	5-25	---	NP
CuA, CuB----------- Crystal Lake	0-12	Silt loam-------	ML, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	12-32	Silt loam, silty clay loam.	CL	A-6, A-4	0	100	100	90-100	70-95	30-39	10-22
	32-60	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	100	100	85-100	65-95	<30	NP-10
CvB, CvC2, CvD, CvE--------------- Cushing	0-20	Loam------------	ML, CL, CL-ML	A-4	0-3	85-100	85-100	80-100	60-80	20-30	3-10
	20-42	Loam, sandy clay loam, clay loam.	SC, CL	A-6, A-7	0-5	80-100	80-100	75-90	40-65	25-45	15-30
	42-60	Loam, sandy clay loam, clay loam.	SC, CL	A-6	0-5	80-100	80-100	75-90	40-65	20-40	10-25
CwD3--------------- Cushing	0-6	Sandy clay loam, clay loam.	SC, CL,	A-6, A-7	0-5	80-100	80-95	75-90	40-65	25-45	15-30
	6-25	Loam, sandy clay loam, clay loam.	SC, CL	A-6, A-7	0-5	80-100	80-95	75-90	40-65	25-45	15-30
	25-60	Loam, sandy clay loam, clay loam.	SC, CL	A-6	0-5	80-100	80-95	75-90	40-65	20-40	10-25
CxB*, CxC2*, CxD2*- Cushing	0-20	Loam------------	ML, CL, CL-ML	A-4	0-3	85-100	85-100	80-100	60-80	20-30	3-10
	20-42	Loam, sandy clay loam, clay loam.	SC, CL	A-6, A-7	0-5	80-100	80-95	75-90	40-65	25-45	15-30
	42-60	Loam, sandy clay loam, clay loam.	SC, CL	A-6	0-5	80-100	80-95	75-90	40-65	20-40	10-25
DaA, DaB----------- Dakota	0-16	Loam------------	ML	A-4	0	95-100	95-100	80-95	50-65	25-35	5-10
	16-30	Loam, sandy clay loam, clay loam.	CL, SC	A-4, A-6, A-2	0	95-100	85-100	80-95	50-80	30-40	8-15
	30-38	Loamy sand, gravelly sand, sand.	SM, SP-SM, SM-SC	A-2	0	95-100	70-100	50-80	10-30	<20	NP-5
	38-60	Sand, coarse sand, gravelly sand.	SP	A-1	0	95-100	70-100	30-50	2-5	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
DlA------------- Dakota	0-15	Loam------------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	60-90	20-30	3-10
	15-29	Loam, sandy loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	90-100	60-90	35-75	20-29	7-13
	29-32	Sandy loam, loamy sand, gravelly loam.	SM, SM-SC	A-4, A-2, A-1	0	85-100	75-95	45-70	15-50	<20	2-6
	32-44	Stratified coarse sand to gravel.	SM, SP, SP-SM	A-1, A-2, A-3	0	80-100	75-95	45-65	0-15	---	NP
	44-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
DvA------------- Dakota Variant	0-13	Silt loam-------	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	70-90	20-30	3-10
	13-29	Loam, sandy loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	90-100	60-90	35-75	20-29	7-13
	29-34	Loamy sand, sandy loam, gravelly loamy coarse sand.	SM, SM-SC	A-4, A-2, A-1	0-10	85-100	60-90	45-70	15-50	<20	2-6
	34-60	Stratified coarse sand to gravel.	SM, SP, SP-SM	A-1, A-2, A-3	0-10	80-100	60-90	45-65	0-15	---	NP
EmD------------- Emmert	0-3	Gravelly sandy loam.	SM, SM-SC	A-1	0-10	80-90	65-85	30-50	10-20	<20	NP-4
	3-60	Gravelly coarse sand.	GW, GP, SP, SW	A-1	0-10	35-60	25-45	10-25	0-5	---	NP
Fa*. Fluvaquents											
Fe*. Fluvaquents, wet											
FnB------------- Freeon	0-18	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-95	65-80	20-30	3-10
	18-27	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	90-95	75-90	25-35	5-15
	27-34	Loam, sandy clay loam, sandy loam.	ML, SC, CL, SM	A-4, A-6	0-5	95-100	85-95	65-75	40-60	15-30	NP-11
	34-60	Sandy loam, loam, loamy sand.	SM, SM-SC, SC	A-4, A-2, A-6	0-5	90-100	80-90	55-65	25-50	<30	NP-15
HrB------------- Hubbard	0-18	Loamy sand------	SM, SP-SM	A-2	0	98-100	95-100	50-80	10-25	<20	NP
	18-35	Sand, coarse sand, loamy sand.	SP-SM, SW-SM	A-1, A-3, A-2-4	0	98-100	70-100	25-75	5-12	<20	NP
	35-60	Sand, coarse sand.	SP, SW	A-1, A-3, A-2-4	0	95-100	70-100	20-70	2-5	<20	NP
LnA------------- Lino	0-18	Loamy fine sand	SM	A-2	0	100	100	95-100	15-30	<20	NP
	18-41	Fine sand, loamy fine sand.	SM	A-2	0	100	100	95-100	12-25	<20	NP
	41-60	Fine sand, sand	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	<20	NP

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MaA, MaB----------- Magnor	0-9	Silt loam-------	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	70-90	20-30	3-8
	9-18	Silt loam, silt	ML, CL, CL-ML	A-4	0-5	95-100	95-100	90-100	70-100	20-30	2-10
	18-22	Silt loam, loam	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	85-100	60-90	20-30	5-12
	22-32	Loam, sandy loam	ML, SM, CL, SC	A-2, A-4	0-10	90-100	85-95	60-85	30-70	15-25	2-10
	32-60	Sandy loam------	SM, SM-SC	A-2, A-4	0-10	90-100	85-95	60-70	30-40	15-20	NP-6
Mk----------------- Markey	0-35	Sapric material	Pt	A-8	---	---	---	---	---	---	---
	35-60	Sand, loamy sand	SP, SM	A-2, A-3	0	100	90-100	60-75	0-20	---	NP
MnB, MnC, MnD------ Menahga	0-11	Loamy sand------	SM, SP-SM	A-2	0	95-100	85-100	60-80	10-30	---	NP
	11-60	Coarse sand, sand.	SP, SP-SM	A-3, A-2	0	95-100	85-100	50-75	0-10	---	NP
MoB---------------- Mora	0-11	Loam------------	SM, ML	A-4	0-2	90-100	80-100	70-100	40-100	<25	NP-4
	11-33	Fine sandy loam, sandy loam, loam.	SM, ML	A-4	0-2	90-100	80-100	70-90	40-60	<20	NP-4
	33-60	Fine sandy loam, sandy loam.	SM	A-4, A-2	0-4	85-100	70-90	60-80	30-40	<20	NP-4
Ns----------------- Newson	0-8	Loamy fine sand	SM	A-2, A-4	0	100	100	50-85	15-50	---	NP
	8-24	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-75	5-30	---	NP
	24-60	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-75	5-30	---	NP
NyA---------------- Nymore	0-8	Fine sand-------	SM, SP-SM	A-2, A-3	0	95-100	80-100	50-75	5-35	---	NP
	8-60	Sand, fine sand	SP-SM, SM	A-2, A-3	0	95-100	80-100	50-75	5-35	---	NP
OgB, OgC, OgD------ Omega	0-21	Fine sand-------	SM, SP-SM	A-2	0	95-100	90-100	70-90	5-20	<20	NP-5
	21-60	Sand, fine sand	SP, SP-SM	A-3	0	95-100	90-100	70-90	1-10	---	NP
Pg*. Pits											
PvA---------------- Plover	0-10	Fine sandy loam	ML, SM	A-2, A-4	0	100	100	60-85	30-55	<20	1-4
	10-18	Silt loam, fine sandy loam, loamy fine sand.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	100	50-100	15-90	<20	1-5
	18-32	Sandy loam, fine sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	100	100	60-95	30-70	<25	2-7
	32-60	Stratified silt to fine sand.	SM, ML, CL-ML, SM-SC	A-4	0	100	100	65-100	40-70	<25	2-7
PxA---------------- Poskin	0-12	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	3-10
	12-37	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-95	25-45	10-25
	37-39	Sandy loam, loam, gravelly sandy loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0-10	80-100	80-100	50-85	25-65	<20	2-6
	39-60	Sand and gravel	SP, SP-SM, GP, GP-GM	A-1, A-2, A-3	0-10	50-90	40-85	20-55	2-10	---	NP
Rf----------------- Rifle	0-9	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	9-60	Hemic material, sapric material.	Pt	A-8	0	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
RoA, RoB, RoC2, RoD-------------- Rosholt	0-7	Loam------------	ML, SM	A-4	0	75-100	75-100	45-90	30-75	20-30	NP-5
	7-32	Loam, sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	75-100	75-100	25-90	15-75	<20	NP-5
	32-37	Gravelly sandy loam, loamy sand.	SM, SC, CL, ML	A-2, A-4, A-1	0-5	50-90	50-90	30-90	15-75	<35	2-16
	37-60	Sand and gravel	GP, SP, SP-SM, GP-GM	A-1	0-15	40-90	40-90	10-65	0-10	---	NP
RpB*, RpC*, RpD*, RpE*: Rosholt----------	0-7	Loam------------	ML, SM	A-4	0	75-100	75-100	45-90	30-75	20-30	NP-5
	7-32	Loam, sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	75-100	75-100	25-90	15-75	<20	NP-5
	32-37	Gravelly sandy loam, loamy sand.	SM, SC, CL, ML	A-2, A-4, A-1	0-5	50-90	50-90	30-90	15-75	<35	2-16
	37-60	Sand and gravel	GP, SP, SP-SM, GP-GM	A-1	0-15	40-90	40-90	10-65	0-10	---	NP
Cromwell---------	0-13	Sandy loam------	SM	A-4, A-2	0	95-100	90-100	55-85	20-45	<20	NP
	13-60	Sand, coarse sand.	SM, SP, SP-SM	A-1, A-3, A-2	0	95-100	60-100	35-70	0-15	<20	NP
RvB---------------- Rosholt Variant	0-19	Silt loam-------	ML	A-4	0	95-100	90-100	90-100	70-100	20-30	1-6
	19-23	Loam, clay loam, silty clay loam.	CL	A-6	0	95-100	90-100	85-100	60-95	25-40	10-21
	23-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SaB, SaC, SaD------ Santiago	0-12	Silt loam-------	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	70-100	20-30	3-10
	12-24	Silt loam-------	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	70-100	20-30	5-12
	24-38	Loam, sandy loam, fine sandy loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-5	70-90	70-90	70-85	25-65	<30	NP-11
	38-60	Sandy loam, loam, loamy sand.	SM, SC, ML, CL	A-2, A-4, A-6	0-5	70-90	70-90	50-85	20-75	<30	NP-15
ScB*, ScC*, ScD*: Santiago----------	0-12	Silt loam-------	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	70-100	20-30	3-10
	12-24	Silt loam-------	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	70-100	20-30	5-12
	24-38	Loamy, sandy loam, fine sandy loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-5	70-90	70-90	70-85	25-65	<30	NP-11
	38-60	Sandy loam, loam, loamy sand.	SM, SC, ML, CL	A-2, A-4, A-6	0-5	70-90	70-90	50-85	20-75	<30	NP-15

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
ScB*, ScC*, ScD*:											
Antigo	0-10	Silt loam	ML, CL, CL-ML	A-4	0	100	100	90-100	80-100	20-30	3-10
	10-14	Silt loam, silt	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	15-30	2-12
	14-30	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	80-90	70-90	25-45	10-25
	30-34	Loam, sandy loam, gravelly sandy loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	85-100	80-100	50-85	25-65	<20	2-6
	34-60	Stratified sand to gravel.	SP, SP-SM, GP, GP-GM	A-2, A-3, A-1	0-3	50-90	40-85	25-55	2-10	---	NP
Se*. Saprists and Aquents											
Sm Seelyeville	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
Us*. Udorthents, sandy											
Uy*. Udorthents, loamy											
Wv Warman Variant	0-9	Sandy loam	SM	A-2, A-4	0	95-100	90-100	60-70	30-40	<20	1-4
	9-19	Sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4	0	95-100	90-100	60-70	30-50	<20	2-6
	19-28	Gravelly loamy sand, loamy sand, gravelly sandy loam.	SM, SP-SM	A-1, A-2, A-3	0-10	80-90	50-90	30-65	5-30	<20	NP
	28-60	Stratified coarse sand to gravel.	SP, SP-SM	A-1, A-2, A-3	0-10	50-90	50-90	20-55	2-10	---	NP

* See map unit description for the composition and behavior of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi-bility group
	In	In/hr	In/in	pH						
Ad------------------	0-10	0.6-2.0	0.18-0.24	5.1-7.3	Low--------	High-----	Moderate	0.28	5	6
Adolph	10-25	0.6-2.0	0.17-0.22	5.1-7.3	Low--------	High-----	Low------	0.28		
	25-60	0.2-0.6	0.07-0.13	6.1-7.8	Low--------	High-----	Low------	0.28		
AfA, AfB, AfC2, AfD	0-8	0.6-2.0	0.13-0.18	6.1-6.5	Low--------	Low------	Low------	0.28	5	3
Alban	8-20	0.6-6.0	0.09-0.22	5.1-7.3	Low--------	Low------	Moderate	0.28		
	20-56	0.6-2.0	0.12-0.17	5.1-7.3	Low--------	Low------	Moderate	0.28		
	56-60	0.6-2.0	0.11-0.22	5.6-7.3	Low--------	Low------	Low------	0.28		
Ag------------------	0-16	0.6-2.0	0.20-0.24	5.1-7.3	Low--------	Moderate	Moderate	0.32	5	5
Alstad	16-20	0.6-2.0	0.17-0.20	5.1-7.3	Moderate	High-----	Moderate	0.32		
	20-45	0.6-2.0	0.15-0.19	5.6-7.8	Moderate	High-----	Low------	0.32		
	45-60	0.2-0.6	0.15-0.19	5.6-8.4	Moderate	High-----	Low------	0.32		
AlB, AlC, AlD, AlE-	0-19	0.6-2.0	0.13-0.18	4.5-7.3	Low--------	Moderate	High-----	0.24	3	3
Amery	19-35	0.2-2.0	0.12-0.19	5.6-7.3	Low--------	Low------	Moderate	0.24		
	35-60	0.2-2.0	0.08-0.16	5.6-6.5	Low--------	Low------	Moderate	0.17		
AnB, AnC------------	0-19	0.6-2.0	0.20-0.22	4.5-6.0	Low--------	Moderate	High-----	0.32	3	5
Amery	19-38	0.2-2.0	0.12-0.19	5.6-7.3	Low--------	Low------	Moderate	0.24		
	38-60	0.2-2.0	0.08-0.16	5.6-6.5	Low--------	Low------	Moderate	0.17		
AoB*, AoC*, AoD*, AoE*, ArC*, ArD*--	0-19	0.6-2.0	0.13-0.18	4.5-7.3	Low--------	Moderate	High-----	0.24	3	3
Amery	19-35	0.2-2.0	0.12-0.19	5.6-7.3	Low--------	Low------	Moderate	0.24		
	35-60	0.2-2.0	0.08-0.16	5.6-6.5	Low--------	Low------	Moderate	0.17		
AtA, AtB, AtC2------	0-10	0.6-2.0	0.22-0.24	4.5-6.5	Low--------	Moderate	High-----	0.37	4	5
Antigo	10-14	0.6-2.0	0.20-0.22	4.5-6.5	Low--------	Moderate	High-----	0.37		
	14-30	0.6-2.0	0.18-0.22	4.5-6.5	Moderate	Moderate	High-----	0.37		
	30-34	0.6-2.0	0.10-0.19	4.5-6.5	Low--------	Moderate	High-----	0.37		
	34-60	>20	0.02-0.04	5.1-7.3	Low--------	Moderate	High-----	0.10		
AuA-----------------	0-13	0.6-2.0	0.22-0.24	5.1-6.5	Low--------	High-----	Moderate	0.43	5	5
Auburndale	13-31	0.2-2.0	0.20-0.22	4.5-6.0	Low--------	High-----	High-----	0.43		
	31-60	0.2-0.6	0.17-0.19	5.6-6.5	Low--------	High-----	Moderate	0.32		
Ba------------------	0-16	0.6-2.0	0.22-0.24	5.1-7.3	Low--------	High-----	Low------	0.37	5	5
Barronett	16-34	0.2-0.6	0.18-0.22	5.1-7.3	Low--------	High-----	Low------	0.37		
	34-60	0.2-2.0	0.17-0.22	5.6-7.8	Low--------	High-----	Low------	0.37		
Be------------------	0-12	0.6-2.0	0.16-0.18	5.1-6.5	Low--------	High-----	Moderate	0.20	5	3
Barronett Variant	12-31	0.6-2.0	0.15-0.22	4.5-6.5	Low--------	High-----	High-----	0.20		
	31-60	0.6-2.0	0.11-0.22	4.5-6.5	Moderate	High-----	High-----	0.20		
Bf------------------	0-10	0.6-2.0	0.20-0.24	5.6-6.5	Low--------	High-----	Moderate	0.28	5	6
Bluffton	10-26	0.6-6.0	0.15-0.17	5.6-7.3	Low--------	High-----	Low------	0.28		
	26-60	0.2-0.6	0.15-0.19	7.4-8.4	Low--------	High-----	Low------	0.28		
BlA-----------------	0-7	0.6-2.0	0.22-0.24	4.5-6.5	Low--------	Moderate	Moderate	0.32	4	5
Brill	7-14	0.6-2.0	0.20-0.22	4.5-6.5	Low--------	Moderate	Moderate	0.43		
	14-32	0.6-2.0	0.18-0.22	4.5-6.5	Moderate	Moderate	Moderate	0.43		
	32-39	0.6-6.0	0.10-0.22	4.5-6.5	Low--------	Moderate	Moderate	0.43		
	39-60	>20	0.02-0.04	5.1-7.3	Low--------	Moderate	Moderate	0.10		
BpA, BpB, BpC2------	0-11	2.0-6.0	0.13-0.15	5.1-6.1	Low--------	Low------	High-----	0.20	3	3
Burkhardt	11-19	2.0-6.0	0.12-0.19	5.1-6.5	Low--------	Low------	High-----	0.10		
	19-60	6.0-20	0.02-0.04	5.6-6.5	Low--------	Low------	Moderate	0.10		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
CaA, CaB, CaC2-----	0-14	0.6-2.0	0.22-0.24	5.6-7.3	Low-------	Low------	Moderate	0.37	5	5
Campia	14-39	0.6-2.0	0.18-0.22	4.5-6.5	Low-------	Moderate	Moderate	0.37		
	39-60	0.6-2.0	0.20-0.22	5.1-7.3	Low-------	Low------	Low------	0.37		
CbB, CbC, CbD------	0-7	0.6-2.0	0.20-0.22	5.1-6.5	Low-------	Low------	Moderate	0.32	3	5
Campia Variant	7-11	0.6-2.0	0.17-0.20	5.1-7.3	Moderate	Moderate	Moderate	0.32		
	11-29	0.2-0.6	0.11-0.13	5.1-7.3	Moderate	Moderate	Moderate	0.32		
	29-60	0.2-0.6	0.11-0.19	7.4-8.4	Moderate	High-----	Low------	0.32		
Cc-----------------	0-39	2.0-6.0	0.45-0.55	5.1-6.5	----------	High-----	Low------	0.10	5	3
Cathro	39-60	0.2-0.6	0.11-0.22	5.1-7.3	Low-------	High-----	Low------	0.24		
ChB, ChC2, ChD2----	0-8	2.0-6.0	0.13-0.15	5.1-6.5	Low-------	Low------	High-----	0.20	3	3
Chetek	8-17	2.0-6.0	0.12-0.19	5.1-6.5	Low-------	Low------	High-----	0.20		
	17-60	6.0-20	0.05-0.07	5.1-6.5	Low-------	Moderate	High-----	0.10		
CmA----------------	0-15	0.6-2.0	0.22-0.24	5.1-6.5	Low-------	High-----	Moderate	0.37	5	5
Comstock	15-34	0.6-2.0	0.18-0.22	4.5-6.5	Low-------	High-----	High-----	0.37		
	34-60	0.6-2.0	0.20-0.22	5.1-6.5	Low-------	High-----	Moderate	0.37		
CpA----------------	0-7	0.6-2.0	0.20-0.22	5.1-6.5	Low-------	Moderate	Moderate	0.37	3	5
Comstock Variant	7-14	0.6-2.0	0.12-0.19	5.1-6.5	Low-------	Moderate	Moderate	0.37		
	14-34	0.2-0.6	0.11-0.13	5.1-6.5	Moderate	High-----	Moderate	0.37		
	34-60	0.2-0.6	0.10-0.12	6.6-8.4	Moderate	High-----	Moderate	0.37		
CrA, CrB, CrC, CrD-	0-13	0.6-2.0	0.16-0.18	4.5-6.0	Low-------	Low------	Moderate	0.20	3	3
Cromwell	13-60	6.0-20	0.05-0.07	4.5-6.5	Low-------	Low------	Moderate	0.15		
CsA----------------	0-16	2.0-6.0	0.13-0.15	5.6-7.3	Low-------	Moderate	Moderate	0.32	3	3
Cromwell Variant	16-20	2.0-6.0	0.09-0.11	5.6-7.3	Low-------	Moderate	Moderate	0.17		
	20-60	6.0-20	0.02-0.07	6.1-7.3	Low-------	Moderate	Low------	0.10		
CtA----------------	0-8	6.0-20	0.10-0.12	4.5-7.3	Low-------	Low------	Moderate	0.15	5	2
Croswell	8-40	6.0-20	0.06-0.08	4.5-6.5	Low-------	Low------	Moderate	0.15		
	40-60	6.0-20	0.05-0.07	5.6-7.3	Low-------	Low------	Moderate	0.15		
CuA, CuB-----------	0-12	0.6-2.0	0.22-0.24	5.6-6.5	Low-------	Moderate	Moderate	0.37	5	5
Crystal Lake	12-32	0.6-2.0	0.18-0.22	4.5-6.0	Low-------	Moderate	High-----	0.37		
	32-60	0.6-2.0	0.20-0.22	4.5-6.5	Low-------	Moderate	High-----	0.37		
CvB, CvC2, CvD, CvE, CwD3, CxB*, CxC2*, CxD2*------	0-20	0.6-2.0	0.20-0.24	5.1-7.8	Low-------	Moderate	Moderate	0.32	5	5
Cushing	20-42	0.2-2.0	0.15-0.19	5.1-7.3	Moderate	Moderate	Low------	0.32		
	42-60	0.2-0.6	0.15-0.19	6.1-8.4	Moderate	Moderate	Low------	0.32		
DaA, DaB-----------	0-16	0.6-2.0	0.20-0.22	5.6-7.3	Low-------	Low------	Moderate	0.28	4	5
Dakota	16-30	0.6-2.0	0.17-0.19	5.1-7.3	Low-------	Low------	Moderate	0.28		
	30-38	6.0-20	0.08-0.10	5.1-7.3	Low-------	Low------	Low------	0.17		
	38-60	>20	0.02-0.04	5.1-7.3	Low-------	Low------	Low------	0.17		
DlA----------------	0-15	0.6-2.0	0.20-0.24	6.6-7.3	Low-------	Low------	Low------	0.28	3	5
Dakota	15-29	0.6-2.0	0.12-0.18	5.6-7.3	Low-------	Low------	Low------	0.32		
	29-32	2.0-6.0	0.08-0.13	5.1-6.0	Low-------	Low------	Moderate	0.20		
	32-44	>20	0.02-0.04	5.1-6.0	Low-------	Moderate	Moderate	0.10		
	44-60	---	---	---	----------	---------	---------	---		
DvA----------------	0-13	0.6-2.0	0.22-0.24	5.6-7.3	Low-------	Moderate	Moderate	0.32	3	5
Dakota Variant	13-29	0.6-2.0	0.12-0.18	5.6-6.5	Low-------	High-----	Moderate	0.32		
	29-34	2.0-6.0	0.08-0.13	5.6-7.3	Low-------	Moderate	Moderate	0.20		
	34-60	>20	0.02-0.04	6.1-7.3	Low-------	Moderate	Moderate	0.10		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
EmD----------------- Emmert	0-3	6.0-20	0.10-0.13	5.1-6.5	Low--------	Low------	Moderate	0.15	2	8
	3-60	>20	0.02-0.04	5.1-7.3	Low--------	Low------	Moderate	0.15		
Fa*. Fluvaquents										
Fe*. Fluvaquents, wet										
FnB----------------- Freeon	0-18	0.6-2.0	0.22-0.24	4.5-7.3	Low--------	Moderate	Moderate	0.37	5	5
	18-27	0.6-2.0	0.18-0.22	4.5-6.5	Moderate	Moderate	Moderate	0.37		
	27-34	0.2-2.0	0.15-0.19	5.1-6.5	Low--------	Moderate	Moderate	0.37		
	34-60	0.2-2.0	0.10-0.16	5.6-7.3	Low--------	Moderate	Moderate	0.28		
HrB----------------- Hubbard	0-18	6.0-20	0.08-0.12	5.1-7.3	Low--------	Low------	Moderate	0.15	5	2
	18-35	6.0-20	0.03-0.07	5.6-6.5	Low--------	Low------	Moderate	0.15		
	35-60	6.0-20	0.03-0.07	6.1-7.3	Low--------	Low------	Moderate	0.15		
LnA----------------- Lino	0-18	6.0-20	0.10-0.12	5.1-6.0	Low--------	Low------	High-----	0.17	5	2
	18-41	6.0-20	0.06-0.08	5.1-6.0	Low--------	Low------	High-----	0.17		
	41-60	6.0-20	0.05-0.07	5.6-6.5	Low--------	Low------	Moderate	0.17		
MaA, MaB----------- Magnor	0-9	0.6-2.0	0.22-0.24	5.1-7.3	Low--------	High-----	Moderate	0.37	5	5
	9-18	0.6-2.0	0.20-0.22	5.1-6.5	Low--------	High-----	Moderate	0.37		
	18-22	0.6-2.0	0.17-0.22	5.1-6.5	Low--------	High-----	Moderate	0.37		
	22-32	0.6-2.0	0.12-0.19	5.1-6.5	Low--------	High-----	Moderate	0.28		
	32-60	0.2-0.6	0.11-0.13	5.1-6.5	Low--------	High-----	Moderate	0.28		
Mk------------------ Markey	0-35	2.0-6.0	0.35-0.45	5.6-6.5	-----------	High-----	Low------	0.10	5	3
	35-60	6.0-20	0.03-0.08	6.1-7.3	Low--------	High-----	Low------	0.10		
MnB, MnC, MnD------ Menahga	0-11	6.0-20	0.10-0.12	4.5-6.0	Low--------	Low------	Moderate	0.15	5	2
	11-60	6.0-20	0.05-0.07	4.5-6.5	Low--------	Low------	Moderate	0.15		
MoB----------------- Mora	0-11	0.6-2.0	0.17-0.20	5.1-6.5	Low--------	Moderate	Moderate	0.28	3	5
	11-33	0.6-6.0	0.15-0.19	5.1-6.5	Low--------	Moderate	Moderate	0.28		
	33-60	0.2-0.6	0.08-0.14	5.6-6.5	Low--------	Moderate	Moderate	0.28		
Ns------------------ Newson	0-8	6.0-20.0	0.10-0.13	3.6-6.0	Low--------	High-----	High-----	0.17	5	2
	8-24	6.0-20	0.09-0.11	3.6-6.0	Low--------	High-----	High-----	0.17		
	24-60	6.0-20	0.05-0.11	4.5-6.5	Low--------	High-----	High-----	0.17		
NyA----------------- Nymore	0-8	6.0-20	0.07-0.09	5.1-6.0	Low--------	Low------	Moderate	0.17	5	1
	8-60	6.0-20	0.02-0.08	5.1-6.5	Low--------	Low------	Moderate	0.17		
OgB, OgC, OgD------ Omega	0-21	6.0-20	0.10-0.12	4.5-6.5	Low--------	Low------	Moderate	0.17	5	2
	21-60	6.0-20	0.05-0.07	5.1-7.3	Low--------	Low------	Moderate	0.17		
Pg*. Pits										
PvA----------------- Plover	0-10	0.6-2.0	0.13-0.18	6.1-7.3	Low--------	Low------	Low------	0.28	5	3
	10-18	0.6-2.0	0.09-0.20	5.1-6.5	Low--------	Moderate	High-----	0.37		
	18-32	0.6-2.0	0.12-0.17	5.1-6.5	Low--------	Moderate	High-----	0.37		
	32-60	0.6-2.0	0.11-0.22	5.6-7.3	Low--------	Moderate	Moderate	0.37		
PxA----------------- Poskin	0-12	0.6-2.0	0.22-0.24	5.1-6.5	Low--------	Moderate	Moderate	0.37	4	5
	12-37	0.6-2.0	0.18-0.20	4.5-5.5	Low--------	Moderate	Moderate	0.37		
	37-39	0.6-2.0	0.10-0.19	5.6-6.5	Low--------	Moderate	Moderate	0.37		
	39-60	>20	0.02-0.04	5.6-6.5	Low--------	Moderate	Moderate	0.10		
Rf------------------ Rifle	0-9	>6.0	0.55-0.65	5.6-7.3	-----------	High-----	Low------	---	---	5
	9-60	2.0-6.0	0.45-0.55	5.6-7.3	-----------	High-----	Low------	---		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi- bility group
	In	In/hr	In/in	pH						
RoA, RoB, RoC2, RoD: Rosholt	0-7	0.6-6.0	0.20-0.22	5.1-6.5	Low	Low	Moderate	0.28	3	5
	7-32	0.6-6.0	0.09-0.15	5.1-6.5	Low	Low	Moderate	0.20		
	32-37	2.0-6.0	0.04-0.09	5.1-6.5	Low	Low	Moderate	0.20		
	37-60	>20	0.02-0.04	5.1-6.5	Low	Low	Moderate	0.10		
RpB*, RpC*, RpD*, RpE*:										
Rosholt	0-7	0.6-6.0	0.20-0.22	5.1-6.5	Low	Low	Moderate	0.28	3	5
	7-32	0.6-6.0	0.09-0.15	5.1-6.5	Low	Low	Moderate	0.20		
	32-37	2.0-6.0	0.04-0.09	5.1-6.5	Low	Low	Moderate	0.20		
	37-60	>20	0.02-0.04	5.1-6.5	Low	Low	Moderate	0.10		
Cromwell	0-13	0.6-2.0	0.16-0.18	4.5-6.0	Low	Low	Moderate	0.20	3	3
	13-60	6.0-20	0.05-0.07	5.1-6.5	Low	Low	Moderate	0.15		
RvB: Rosholt Variant	0-19	0.6-2.0	0.22-0.24	6.1-8.4	Low	Low	Low	0.32	3	5
	19-23	0.6-2.0	0.15-0.20	6.1-8.4	Moderate	Low	Low	0.32		
	23-60	---	---	---	---	---	---	---		
SaB, SaC, SaD: Santiago	0-12	0.6-2.0	0.22-0.24	5.6-7.3	Low	Moderate	High	0.37	5	5
	12-24	0.6-2.0	0.20-0.22	4.5-6.5	Low	Moderate	High	0.37		
	24-38	0.6-2.0	0.12-0.19	4.5-6.5	Low	Moderate	High	0.37		
	38-60	0.2-2.0	0.08-0.19	5.6-6.5	Low	Low	Moderate	0.28		
ScB*, ScC*, ScD*:										
Santiago	0-12	0.6-2.0	0.22-0.24	6.1-7.3	Low	Moderate	High	0.37	5	5
	12-24	0.6-2.0	0.20-0.22	4.5-6.5	Low	Moderate	High	0.37		
	24-38	0.6-2.0	0.12-0.19	4.5-6.5	Low	Moderate	High	0.37		
	38-60	0.2-2.0	0.08-0.19	5.6-6.5	Low	Low	Moderate	0.28		
Antigo	0-10	0.6-2.0	0.22-0.24	4.5-6.5	Low	Moderate	High	0.37	4	5
	10-14	0.6-2.0	0.20-0.22	4.5-6.5	Low	Moderate	High	0.37		
	14-30	0.6-2.0	0.18-0.22	4.5-6.5	Moderate	Moderate	High	0.37		
	30-34	0.6-2.0	0.10-0.19	4.5-6.5	Low	Moderate	High	0.37		
	34-60	>20	0.02-0.04	5.1-7.3	Low	Moderate	High	0.10		
Se*. Saprists and Aquents										
Sm: Seelyeville	0-60	2.0-6.0	0.35-0.45	5.6-7.3	---	High	Moderate	0.10	5	3
Us*. Udorthents, sandy										
Uy*. Udorthents, loamy										
Wv: Warman Variant	0-9	2.0-6.0	0.13-0.15	5.1-6.5	Low	High	Moderate	0.24	3	3
	9-19	2.0-6.0	0.12-0.17	5.1-6.5	Low	High	Moderate	0.24		
	19-28	6.0-20	0.09-0.11	5.6-6.5	Low	High	Moderate	0.17		
	28-60	>20	0.02-0.04	5.6-6.5	Low	High	Moderate	0.10		

* See map unit description for the composition and behavior of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Subsidence	Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Total	
					Ft			In		In	
Ad----------------- Adolph	B/D	Common------	Long------	Oct-Jun	0-1.0	Perched	Apr-Jul	>60	---	---	High.
AfA, AfB, AfC2, AfD-------------- Alban	B	None---------	---	---	>6.0	Apparent	Nov-Apr	>60	---	---	Moderate.
Ag----------------- Alstad	C	Rare---------	---	---	1.0-3.0	Perched	Nov-May	>60	---	---	High.
AlB, AlC, AlD, AlE, AnB, AnC, AoB*, AoC*, AoD*, AoE*, ArC*, ArD*- Amery	B	None---------	---	---	>6.0	---	---	>60	---	---	Mo`erate.
AtA, AtB, AtC2----- Antigo	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate.
AuA--------------- Auburndale	D	Frequent----	Brief-----	Nov-Apr	0-1.0	Apparent	Nov-May	>60	---	---	High.
Ba----------------- Barronett	C	Occasional	Brief-----	Nov-Jun	0-1.0	Apparent	Nov-Jun	>60	---	---	High.
Be----------------- Barronett Variant	C	Occasional	Long------	Nov-Jun	0-1.0	Apparent	Nov-May	>60	---	---	High.
Bf----------------- Bluffton	D	Frequent----	Brief to long.	Mar-May	0-1.0	Apparent	Nov-Jun	>60	---	---	High.
BlA---------------- Brill	B	None---------	---	---	3.0-5.0	Apparent	Sep-May	>60	---	---	High.
BpA, BpB, BpC2----- Burkhardt	B	None---------	---	---	>6.0	---	---	>60	---	---	Low.
CaA, CaB, CaC2----- Campia	B	None---------	---	---	>6.0	---	---	>60	---	---	High.
CbB, CbC, CbD------ Campia Variant	C	None---------	---	---	>3.0	Apparent	Nov-May	>60	---	---	Moderate.
Cc----------------- Cathro	A/D	Frequent----	Long------	Nov-May	0-1.0	Apparent	Nov-Jun	>60	---	19-22	High.
ChB, ChC2, ChD2--- Chetek	B	None---------	---	---	>6.0	---	---	>60	---	---	Low.
CmA--------------- Comstock	C	Rare---------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	High.
CpA--------------- Comstock Variant	C	None---------	---	---	1.0-3.0	Apparent	Nov-Ma}	>60	---	---	High.
CrA, CrB, CrC, CrD-------------- Cromwell	A	None---------	---	---	>6.0	---	---	>60	---	---	Low.
CsA--------------- Cromwell Variant	C	None---------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	High.
CtA--------------- Croswell	A	None---------	---	---	2.0-3.0	Apparent	Nov-Apr	>60	---	---	Low.
CuA, CuB---------- Crystal Lake	B	None---------	---	---	2.5-3.5	Apparent	Dec-Apr	>60	---	---	High.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Subsidence	Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Total	
					Ft			In		In	
CvB, CvC2, CvD, CvE, CwD3, CxB*, CxC2*, CxD2*: Cushing	B	None	---	---	>3.0	Perched	Mar-May	>60	---	---	Moderate.
DaA, DaB: Dakota	B	None	---	---	>6.0	---	---	>60	---	---	Low.
DlA: Dakota	C	None	---	---	>6.0	---	---	40-60	Rip-pable	---	Low.
DvA: Dakota Variant	B	Rare	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	High.
EmD: Emmert	A	None	---	---	>6.0	---	---	>60	---	---	Low.
Fa*. Fluvaquents											
Fe*. Fluvaquents, wet											
FnB: Freeon	B	None	---	---	2.0-3.0	Perched	Nov-May	>60	---	---	Moderate.
HrB: Hubbard	A	None	---	---	>6.0	---	---	>60	---	---	Low.
LnA: Lino	B	None	---	---	2.0-4.0	Apparent	Nov-Jun	>60	---	---	Moderate.
MaA, MaB: Magnor	C	Rare	---	---	1.0-3.0	Perched	Nov-Jun	>60	---	---	High.
Mk: Markey	D	Frequent	Long	Nov-May	0-1.0	Apparent	Nov-Jun	>60	---	25-30	High.
MnB, MnC, MnD: Menahga	A	None	---	---	>6.0	---	---	>60	---	---	Low.
MoB: Mora	C	None	---	---	1.0-3.0	Perched	Nov-Jun	>60	---	---	High.
Ns: Newson	A/D	Occasional	Brief	Nov-Jun	0-1.0	Apparent	Nov-Jun	>60	---	---	Moderate.
NyA: Nymore	A	None	---	---	>6.0	---	---	>60	---	---	Low.
OgB, OgC, OgD: Omega	A	None	---	---	>6.0	---	---	>60	---	---	Low.
Pg*. Pits											
PvA: Plover	C	None	---	---	1.0-3.0	Apparent	Nov-May	>60	---	---	High.
PxA: Poskin	C	Rare	---	---	1.0-3.0	Apparent	Sep-May	>60	---	---	High.
Rf: Rifle	A/D	Frequent	Long	Nov-May	0-1.0	Apparent	Nov-Jun	>60	---	50-55	High.
RoA, RoB, RoC2, RoD: Rosholt	B	None	---	---	>6.0	---	---	>60	---	---	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Subsidence	Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Total	
					Ft			In		In	
RpB*, RpC*, RpD*, RpE*:											
Rosholt----------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate.
Cromwell---------	A	None---------	---	---	>6.0	---	---	>60	---	---	Low.
RvB--------------- Rosholt Variant	B	None---------	---	---	>6.0	---	---	20-40	Rip-pable	---	Moderate.
SaB, SaC, SaD----- Santiago	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate.
ScB*, ScC*, ScD*:											
Santiago----------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate.
Antigo------------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate.
Se*. Saprists and Aquents											
Sm---------------- Seelyeville	A/D	Frequent-----	Very long	Apr-Nov	0-2.0	Apparent	Jan-Dec	>60	---	50-55	High.
Us*. Udorthents, sandy											
Uy*. Udorthents, loamy											
Wv---------------- Warman Variant	D	Occasional	Brief------	Nov-Mar	0-1.0	Apparent	Nov-Apr	>60	---	---	High.

* See map unit description for the composition and behavior of the map unit.

TABLE 17.--ENGINEERING TEST DATA

[Tests performed by Wisconsin Department of Transportation, Division of Highways. Absence of an entry indicates that no determination was made]

Soil name and location	Parent material	Sample number	Depth	Moisture density: Maximum dry density	Moisture density: Optimum moisture content	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	Classification: Unified
			In	Lb/cu ft	Pct									Pct			
Amery silt loam: SE1/4SE1/4 sec. 25, T. 36 N., R. 18 W.	Loamy glacial till.	S73WI 48-1-1	20-29	---	---	91	87	69	26	22	16	11	9	---	NP**	A-2-4 (0)	SM
		S73WI 48-1-2	34-60	131.0	8.2	91	86	64	19	16	11	7	4	---	NP	A-2-4 (0)	SM
Amery sandy loam: SW1/4SW1/4 sec. 14, T. 34 N., R. 17 W.	Loamy glacial till.	S75WI 48-1-1	24-36	---	---	90	86	67	27	24	18	10	7	---	NP	A-2-4 (0)	SM
		S75WI 48-1-2	43-60	---	---	87	83	63	25	22	16	10	7	---	NP	A-2-4 (0)	SM
Antigo silt loam: SE1/4NE1/4 sec. 17, T. 34 N., R. 17 W.	Eolian silt over glacial outwash.	S73WI 48-2-1	21-29	---	---	---	100	95	87	82	53	30	25	41.5	22.1	A-7-6 (13)	CL
		S73WI 48-2-2	36-60	---	---	71	66	44	8	7	5	3	3	---	NP	A-1-b (10)	SP-SM
Antigo silt loam: NW1/4SW1/4 sec. 36, T. 35 N., R. 18 W.	Eolian silt over glacial outwash.	S60WI 48-1-1	19-33	118.0	13.0	---	100	94	83	74	47	27	24	37.0	18.0	A-6(11)	CL
		S60WI 48-1-2	36-48	123.0	10.0	89	82	54	7	5	3	2	1	---	NP	A-3(0)	SP-SM
Antigo silt loam: NE1/4 sec. 36, T. 33 N., R. 17 W.	Eolian silt over glacial outwash.	S60WI 48-2-1	16-24	---	---	---	100	88	83	79	51	29	24	44.0	23.0	A-7-6 (14)	CL
		S60WI 48-2-2	33-45	---	---	89	76	38	7	6	4	2	2	---	NP	A-1-b (0)	SP-SM
Antigo silt loam: NE1/4SE1/4 sec. 21, T. 33 N., R. 17 W.	Eolian silt over glacial outwash.	S60WI 48-3-1	12-21	---	---	---	100	93	74	70	48	30	25	37.0	19.0	A-6 (12)	CL
		S60WI 48-3-2	21-32	---	---	90	82	46	4	4	3	2	2	---	NP	A-1-b (0)	SP
Barronett silt loam: SE1/4SW1/4 sec. 27, T. 33 N., R. 15 W.	Silty and loamy lacustrine sediments.	S74WI- 48-3-1	19-24	---	---	---	100	99	95	92	68	39	33	43.7	23.3	A-7-6 (14)	CL
		S74WI- 48-3-2	32-60	---	---	---	100	99	93	81	31	17	13	---	NP	A-4(8)	ML
Barronett Variant fine sandy loam: SE1/4SW1/4 sec. 36, T. 36 N., R. 19 W.	Loamy lacustrine sediments.	S73WI 48-3-1	19-25	---	---	---	100	99	64	49	31	25	23	30.6	12.4	A-6(7)	CL
		S73WI 48-3-2	38-60	---	---	---	100	99	86	74	38	23	19	33.0	13.8	A-6(9)	CL

See footnotes at end of table.

TABLE 17.--ENGINEERING TEST DATA--Continued

Soil name and location	Parent material	Sample number	Depth	Moisture density		Percentage passing sieve--*				Percentage smaller than--*				Liquid limit	Plasticity index	Classification	
				Maximum dry density	Optimum moisture content	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO	Unified
			In	Lb/cu ft	Pct									Pct			
Chetek sandy loam: SE1/4SW1/4 sec. 28, T. 33 N., R. 18 W.	Glacial outwash.	S73WI-48-4-1	5-13	---	---	100	98	85	62	54	34	21	17	30.4	12.6	A-6(6)	CL
		S73WI-48-4-2	19-60	---	---	83	78	43	2	2	2	2	1	---	NP	A-1-6 (0)	SP
Cromwell sandy loam: NE1/4SW1/4 sec. 11, T. 36 N., R. 16 W.	Glacial outwash.	S75WI 48-2-1	4-16	---	---	98	95	74	29	24	17	7	4	---	NP	A-2-4 (0)	SM
		S75WI 48-2-2	26-60	109.9	11.0	98	94	67	5	4	3	2	2	---	NP	A-3(0)	SP-SM
Crystal Lake silt loam: NE1/4SW1/4 sec. 22, T. 35 N., R. 15 W.	Silty lacustrine sediments.	S73WI 48-5-1	20-26	---	---	---	100	98	86	76	36	21	17	31.4	10.0	A-4(8)	CL
		S73WI 48-5-2	32-60	110.0	16.4	---	100	98	94	85	40	18	14	---	NP	A-4(8)	ML
Cushing loam: NE1/4NW1/4NW1/4 sec. 19, T. 36 N., R. 18 W.	Loamy glacial till.	S60WI 48-4-1	13-27	116	14.0	---	100	90	56	52	42	30	25	41.0	27.0	A-7-6 (11)	CL
		S60WI 48-4-2	34-42	120	12.0	---	100	88	48	44	35	25	20	34.0	20.0	A-6(6)	SC
Cushing loam: SE1/4SE1/4SE1/4 sec. 18, T. 36 N., R. 18 W.	Loamy glacial till.	S60WI 48-5-1	19-32	---	---	---	100	89	51	48	39	28	22	36.0	21.0	A-6(7)	CL
		S60WI 48-5-2	35-48	---	---	---	100	89	52	48	37	26	20	33.0	18.0	A-6(6)	CL
Cushing loam: NW1/4NW1/4 sec. 25, T. 36 N., R. 16 W.	Loamy glacial till.	S75WI 48-4-1	20-41	---	---	93	91	80	46	42	34	24	19	31.2	15.1	A-6(4)	CL
		S75WI 48-4-2	49-70	111.8	15.1	98	96	85	52	47	37	25	18	29.3	13.0	A-6(4)	CL
Magnor silt loam: SE1/4SE1/4 sec. 10, T. 32 N., R. 15 W.	Eolian silt over loamy glacial till.	S74WI 48-2-1	18-22	---	---	---	100	97	89	83	51	27	20	30.0	11.1	A-6(8)	CL
		S74WI 48-2-2	32-60	---	---	88	85	66	29	25	17	9	6	---	NP	A-2-4 (0)	SM
Menahga loamy sand: SE1/4NE1/4 sec. 2, T. 37 N., R. 17 W.	Outwash sand.	S74WI 48-4-1	12-28	---	---	---	100	86	4	4	4	3	2	---	NP	A-3(0)	SP
		S74WI 48-4-2	28-60	---	---	---	100	87	2	1	1	1	1	---	NP	A-3(0)	SP

See footnotes at end of table.

TABLE 17.--ENGINEERING TEST DATA--Continued

Soil name and location	Parent material	Sample number	Depth	Moisture density: Maximum dry density	Moisture density: Optimum moisture content	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	Classification: Unified
			In	Lb/cu ft	Pct									Pct			
Omega fine sand:																	
NW1/4SW1/4 sec. 29, T. 36 N.,	Outwash sand.	S73WI 48-6-1	2-21	---	---	---	100	99	3	2	2	2	2	---	NP	A-3(0)	SP
R. 19 W.		S73WI 48-6-2	21-60	99.9	14.7	---	---	100	1	1	1	1	1	---	NP	A-3(0)	SP
Rosholt loam:																	
NE1/4SE1/4 sec. 4, T. 32 N., R. 18 W.	Loamy deposits over glacial outwash.	S73WI-48-7-1	15-25	---	---	---	100	85	68	65	42	23	19	34.4	15.8	A-6(9)	CL
		S73WI-48-7-2	33-60	116.2	10.9	90	85	61	6	6	5	3	2	---	NP	A-3(0)	SP-SM
Santiago silt loam:																	
SW1/4NE1/4 sec. 27, T. 37 N.,	Eolian silt over loamy glacial till.	S75WI 48-3-1	21-27	---	---	---	100	93	75	66	37	23	20	29.5	10.3	A-4(8)	CL
R. 16 W.		S75WI 48-3-2	27-35	---	---	86	83	70	38	33	23	14	11	23.6	7.7	A-4(1)	SC
		S75WI 48-3-3	38-60	133.3	7.6	81	76	52	20	18	15	9	5	---	NP	A-2-4 (0)	SM

* Mechanical analysis according to AASHTO Designation T88-57. Results from this procedure may differ from the results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from 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.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Adolph	Coarse-loamy, mixed, frigid Typic Haplaquolls
Alban	Coarse-loamy, mixed Typic Glossoboralfs
Alstad	Fine-loamy, mixed Aquic Eutroboralfs
Amery	Coarse-loamy, mixed Typic Glossoboralfs
Antigo	Fine-silty over sandy or sandy-skeletal, mixed Typic Glossoboralfs
Auburndale	Fine-silty, mixed, frigid Typic Glossaqualfs
Barronett	Fine-silty, mixed, frigid Mollic Ochraqualfs
Barronett Variant	Fine-loamy, mixed, frigid Typic Haplaquolls
Bluffton	Fine-loamy, mixed, frigid Typic Haplaquolls
Brill	Fine-silty over sandy or sandy-skeletal, mixed Typic Glossoboralfs
*Burkhardt	Sandy, mixed, mesic Typic Hapludolls
Campia	Fine-silty, mixed Typic Glossoboralfs
Campia Variant	Fine, mixed Typic Glossoboralfs
*Cathro	Loamy, mixed, euic Terric Borosaprists
Chetek	Coarse-loamy, mixed Eutric Glossoboralfs
Comstock	Fine-silty, mixed Aquic Glossoboralfs
Comstock Variant	Fine, mixed Aquic Glossoboralfs
Cromwell	Sandy, mixed, frigid Typic Dystrochrepts
Cromwell Variant	Sandy, mixed, frigid Aquic Dystrochrepts
Croswell	Sandy, mixed, frigid Entic Haplorthods
Crystal Lake	Fine-silty, mixed Typic Glossoboralfs
Cushing	Fine-loamy, mixed Glossic Eutroboralfs
*Dakota	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiudolls
Dakota Variant	Fine-loamy, mixed Aquic Argiborolls
Emmert	Sandy-skeletal, mixed, frigid Typic Udorthents
Fluvaquents	Loamy, mixed, nonacid, frigid Fluvaquents
Freeon	Fine-loamy, mixed Typic Glossoboralfs
Hubbard	Sandy, mixed Udorthentic Haploborolls
*Lino	Mixed, frigid Aquic Udipsamments
Magnor	Fine-loamy, mixed Aquic Glossoboralfs
Markey	Sandy or sandy-skeletal, mixed, euic Terric Borosaprists
Menahga	Mixed, frigid Typic Udipsamments
*Mora	Coarse-loamy, mixed Aquic Fragiboralfs
Newson	Mixed, frigid Humaqueptic Psammaquents
*Nymore	Mixed, frigid Typic Udipsamments
Omega	Mixed, frigid Spodic Udipsamments
Plover	Coarse-loamy, mixed Aquic Glossoboralfs
Poskin	Fine-silty over sandy or sandy-skeletal, mixed Aquic Glossoboralfs
Rifle	Euic Typic Borohemists
Rosholt	Coarse-loamy, mixed Typic Glossoboralfs
Rosholt Variant	Fine-loamy, mixed Typic Glossoboralfs
Santiago	Fine-loamy, mixed Typic Glossoboralfs
Saprists and Aquents	Saprists and Aquents
Seelyeville	Euic Typic Borosaprists
Udorthents, loamy	Loamy, mixed, nonacid, frigid Udorthents
Udorthents, sandy	Sandy, mixed, nonacid, frigid Udorthents
Warman Variant	Coarse-loamy, mixed, nonacid, frigid Mollic Haplaquepts

☆ U.S. GOVERNMENT PRINTING OFFICE: 1979 -285-655/31

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.